

Exterior Building Color & Material Samples
Color Drawdowns
Archaeological Resources
Airport Vicinity Development Checklist
Parking Study
Trip Generation Comparison
Parking Master Plan



N O R T H L A N D
RESEARCH, INC.

David Gulino
Land Development Services, L.L.C.
7525 E. Camelback Road
Suite 104
Scottsdale, AZ 85251

RE: Cultural resources survey t 128th Street and Ranch Gate Road

Dear Mr. Gulino,

Northland has reviewed the following report, *A Cultural Resources Survey of 40 Acres Southwest of the Intersection of 128th Street and Ranch Gate Road, Scottsdale, Maricopa County, Arizona* (Northland Technical Report No. 17-69). The survey resulted in no findings and no known archaeological sites have been identified within or adjacent to the 40 acre parcel since the original survey in 2007. The methods used to conduct the survey were done to the current standard and therefore does not warrant any additional work.

Please let me know if you require any further information.

Thank you,

Brent Kober, M.A.S., R.P.A.
Project Manager
1865 E. 3rd Street
Tempe, Arizona
85281

18-ZN-2018
8/17/2018



J2 Engineering and Environmental Design, LLC
 4649 E. Cotton Gin Loop
 Suite B2
 Phoenix, Arizona 85040
 Phone: 602.438.2221
 Fax: 602.438.2225



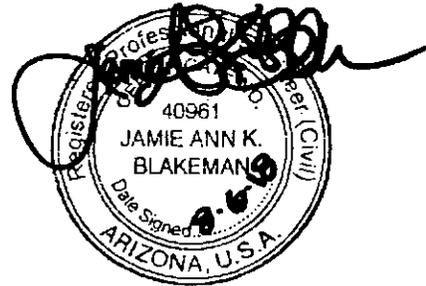
To: David Gulino
 Sustainability Engineering Group

From: Jamie Blakeman, PE, PTOE

Job Number: 18.1100.001

RE: HHL Ranch Gate
 Traffic Impact & Mitigation Analysis

Date: August 6, 2018



EXPIRES 6-30-19



INTRODUCTION

J2 Engineering and Environmental Design (J2) has prepared a Traffic Impact and Mitigation Analysis (TI&MA) for the proposed HHL Ranch Gate residential development located on the southwest corner of Ranch Gate Road and 128th Street in Scottsdale, Arizona. See **Figure 1** for the vicinity map.

The proposed HHL Ranch Gate residential development consists of 33 single-family homes. See **Attachment A** and **Figure 2** for the site plan.

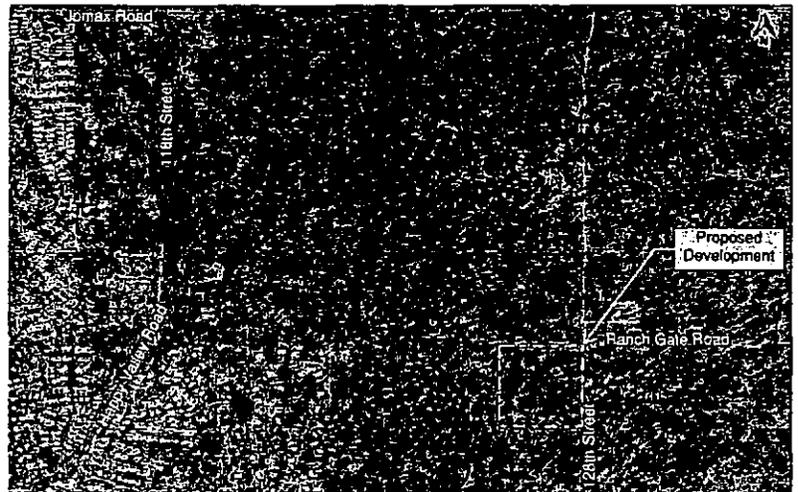


Figure 1 - Vicinity Map

The objective of this Traffic Impact and Mitigation Analysis is to analyze the traffic related impacts of the proposed development to the adjacent roadway network, and to perform a trip generation comparison between the existing zoning (R1-130) and the proposed development.





EXISTING CONDITIONS

The proposed development includes one existing undeveloped parcel currently zoned for R1-130 single-family residential with environmentally sensitive lands overlay (ESL). The parcel is bordered by Ranch Gate Road to the north and 128th Street to the east. The adjacent surrounding area is undeveloped land. Approximately a half mile to the west is a residential community, and approximately a mile to the south is the Tom's Thumb Trailhead.

Ranch Gate Road within the vicinity of the proposed development is an east-west roadway and classified as a rural minor collector according to the *City of Scottsdale Master Transportation Plan*, adopted on July 5, 2016. Ranch Gate Road borders the proposed development to the north and currently provides one (1) through lane for each direction of travel.

128th Street within the vicinity of the proposed development is a north-south roadway that borders the east side of the proposed HHL Ranch Gate residential development. It currently provides one (1) through lane for each direction of travel. This roadway begins at Ranch Gate Road and terminates at Tom's Thumb Trailhead approximately one (1) mile south of Ranch Gate Road. 128th Street is currently unpaved north of Ranch Gate Road to Rio Verde Drive.

118th Street within the vicinity of the proposed development is generally a north-south roadway that provides one (1) lane for each direction of travel with a northbound bike lane. According to the City of Scottsdale Master Transportation Plan 118th Street is classified a rural minor arterial south of Ranch Gate Road, and a rural minor collector north of Ranch Gate Road. There is a posted speed limit of 35 mph. It is anticipated that 118th Street will be constructed to extend north to Rio Verde Drive.

CRASH HISTORY

The most recent 3-year collision history (April 2015 – April 2018) was obtained from the City of Scottsdale for Ranch Gate Road between 118th Street and 128th Street, as well as for 128th Street from Tom's Thumb Trailhead to Ranch Gate Road. During the three-year period, there was 1 collision, of which resulted in no injury. The manner of the collision was reported as a sideswipe opposite direction between a southbound and a northbound vehicle. See **Attachment B** for detailed crash data.



Figure 2 - Site Plan



Collision Rates

The City of Scottsdale’s 2016 *Traffic Volume and Collision Rate Data* report does not provide collision rate information for the adjacent roadway segments or intersections.

PROPOSED DEVELOPMENT

The proposed HHL Ranch Gate residential development consists of 33 single-family homes. A full access driveway to the development is proposed, located approximately 760 feet west of 128th Street along Ranch Gate Road. Additionally, there will be an emergency exit provided, approximately 750 feet south of Ranch Gate Road along 128th Street. See **Figure 2** and **Attachment A**.

TRIP GENERATION (EXISTING ZONING)

The existing parcel is currently zoned R1-130 single-family residential with environmentally sensitive lands overlay. The trip generation for the existing R1-130 single-family residential district zoning was calculated utilizing the Institute of Transportation Engineers (ITE) publication entitled *Trip Generation Manual, 10th Edition*. This publication is considered the standard for the transportation engineering profession. The ITE trip generation rates and fitted curve equations are based on studies that measured the trip generation characteristics for various types of land uses. The rates and equations are expressed in terms of trips per unit of land use type.

According to the City of Scottsdale Code of Ordinances, the R1-130 single-family residential zoning is intended primarily to promote and preserve residential developments. Therefore, a residential development was assumed on this site under the R1-130 single-family residential zoning.

According to the Maricopa County Assessor’s website, the site is currently comprised of an undeveloped parcel with a net site area of 1,710,125 square feet (39 acres). See **Attachment C** for detailed parcel information. According to the City of Scottsdale Code of Ordinances the R1-130 single-family residential district requires a minimum lot area of not less than 130,000 square feet. Therefore, it is reasonable to assume thirteen (13) dwelling units could be developed on this parcel under this zoning.

The ITE *Trip Generation Manual, 10th Edition*, provides both average trip generation rates as well as trip generation equations for Land Use 210. The results of the average rate trip generation calculations are shown in **Table 1**. See **Attachment D** for detailed trip generation calculations.

Table 1 – Trip Generation – Existing Zoning (13 Dwelling Units)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Single-Family Detached Housing (Existing R1-130 Zoning)	210	13	Dwelling Units	123	10	3	8	13	8	5



TRIP GENERATION (PROPOSED DEVELOPMENT)

The proposed HHL Ranch Gate residential development includes 33 single-family detached homes. Keeping consistent with the existing zoning trip generation calculations, the average rates were also used for the proposed HHL Ranch Gate trip generation calculations. The trip generation for the proposed development is shown in **Table 2**. Detailed trip generation calculations are shown in **Attachment D**.

Table 2 – Trip Generation - Proposed HHL Ranch Gate Residential Development

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Single-Family Detached Housing (Proposed R1-43 Zoning)	210	33	Dwelling Units	312	25	6	19	33	21	12

TRIP GENERATION COMPARISON

A comparison between the trips generated by the existing zoning versus the proposed development is shown in **Table 3**.

Table 3 – Trip Generation Comparison (Existing Zoning vs. Proposed Development)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Single-Family Detached Housing (Existing R1-130 Zoning)	210	13	Dwelling Units	123	10	3	8	13	8	5
Single-Family Detached Housing (Proposed R1-43 Zoning)	210	33	Dwelling Units	312	25	6	19	33	21	12
Difference				189	15	4	11	20	13	7

The proposed HHL Ranch Gate residential development is anticipated to generate 189 additional weekday trips, 15 additional AM peak hour trips, and 20 additional PM peak hour trip.

SUMMARY

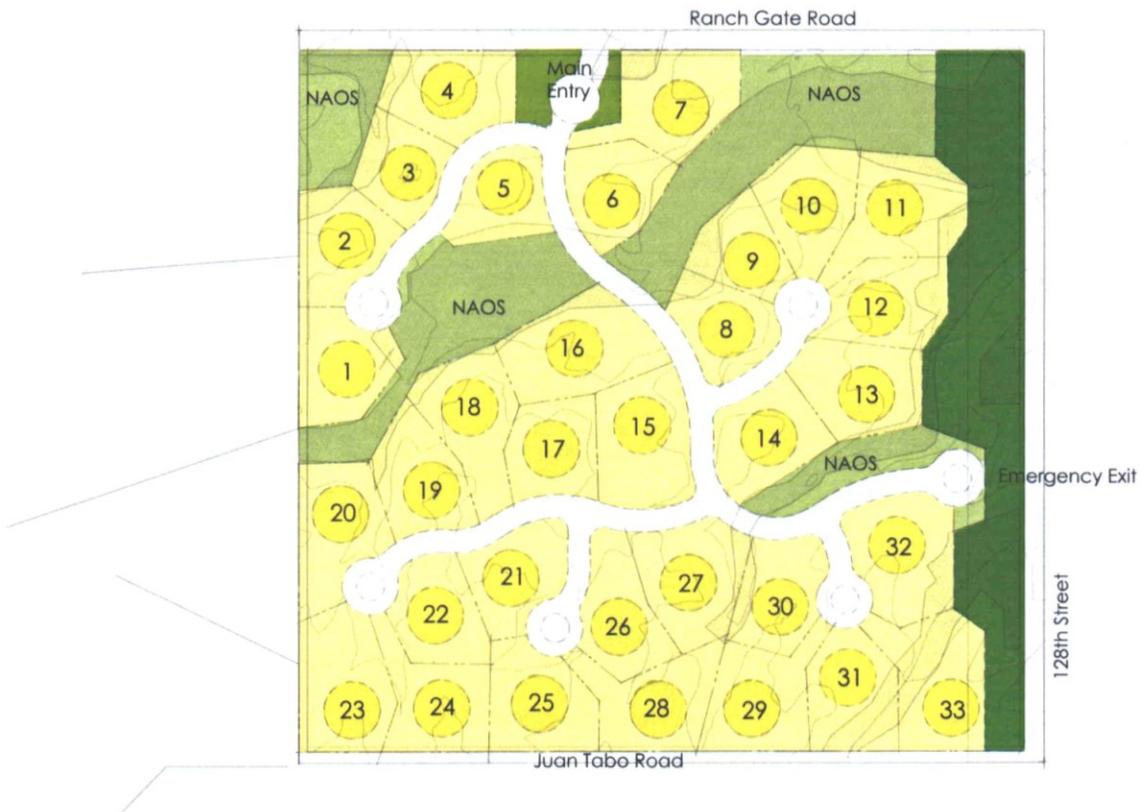
The proposed HHL Ranch Gate residential development with 33 single-family homes is anticipated to generate 312 weekday daily trips, 25 AM peak hour trips, and 33 PM peak hour trips. **Therefore, the proposed HHL Ranch Gate residential development is anticipated to have minimal impacts on the traffic operation of the adjacent roadway network.**



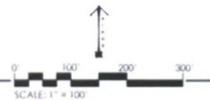
Attachment A

Site Plan

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CONCEPTUAL LOTTING PLAN
 HHL RANCH GATE
 CONCEPT C





Attachment B Crash Data

.....

REPORT #	YYMMDD	HHMM	NS ST	NS SF	EW ST	EW SF	DIR FROM	DIST FROM	INJ SEV 1	INJ SEV 2	PHYSICAL COND 1	PHYSICAL COND 2	VIOL 1	VIOL 2	ACTION 1	ACTION 2	TRAVEL DIR 1	TRAVEL DIR 2	MANNER OF COLLISION	COMMENTS
15-14208	150626	0911	128	ST	LARKSPUR	DR	AT		99		0		1		1		99		97	HIT AND RUN
16-13670	160613	2224	128	ST	INNACLE PEAP	RD	S	101	2		0		2		1		SB		1	
15-09692	150427	1215	128	ST	RANCH GATE	RD	S	300	1	1	0	0	1	1	1	1	SB	NB	7	
16-05970	160312	1412	128	ST	RIO VERDE	DR	AT		1	1	0	0	2	1	1	6	EB	SB	4	
16-25403	161114	1525	128	ST	SHEA	BL	W	300	1	1	0	0		1	1	3	EB	EB	4	
16-25401	161114	1459	128	ST	SHEA	BL	W	75	1	1	0	0	2	1	1	3	EB	EB	4	
16-21906	160930	0734	128	ST	SHEA	BL	W	40	1	1	0	0	2	1	1	2	EB	EB	4	
16-19552	160831	1744	128	ST	SHEA	BL	W	30	1	1	4	0	4	1	1	3	EB	EB	4	DUI
16-18542	160819	0754	128	ST	SHEA	BL	AT		1	3	0	0	2	1	1	2	EB	EB	4	MULTI VEH 3
16-17684	160808	0823	128	ST	SHEA	BL	E	200	1	1	0	0	2	1	1	3	WB	WB	4	
15-21506	151002	1726	128	ST	VIA LINDA		AT		1	3	0	0	20	1	4	1	SB	WB	2	
15-01091	150114	2021	128	ST	VIA LINDA		AT		3	1	0	0	5	1	1	1	SB	EB	2	

REPORT #	YYMMDD	HHMM	NS ST	NS SF	EW ST	EW SF	DIR FROM	DIST FROM	INJ SEV 1	INJ SEV 2	PHYSICAL COND 1	PHYSICAL COND 2	VIOL 1	VIOL 2	ACTION 1	ACTION 2	TRAVEL DIR 1	TRAVEL DIR 2	MANNER OF COLLISION	COMMENTS
1706075	170315	1311	128	ST	PALOOSI	PL	AT		1	1	0	0	99	99	1	1	WB	EB	3	
1720983	170922	1324	128	ST	SHEA	BL	E	189	1		0		1		1		EB		1	
1717651	170810	0723	128	ST	SHEA	BL	E	300	1	2	0	0	2	1	1	2	WB	WB	4	MULTI VEH 4
1715302	170710	1401	128	ST	SHEA	BL	E	10	1	1	0	0	2	1	1	3	WB	WB	4	
1710478	170509	0714	128	ST	SHEA	BL	S	550	1	1	0	0	20	1	4	1	EB	SB	3	
1710187	170505	0754	128	ST	SHEA	BL	AT		1	1	0	0	2	1	1	1	EB	EB	4	
1706132	170316	0653	128	ST	SHEA	BL	AT		99	2	0	0	6	1	1	4	EB	SB	3	
1712107	170529	1249	128	ST	/A LINDA		AT		2	1	0	0	20	1	4	1	SB	WB	2	

REPORT #	YYMMDD	HHMM	NS ST	NS SF	EW ST	EW SF	DIR FROM	DIST FROM	INJ SEV 1	INJ SEV 2	PHYSICAL COND 1	PHYSICAL COND 2	VIOL 1	VIOL 2	ACTION 1	ACTION 2	TRAVEL DIR 1	TRAVEL DIR 2	MANNER OF COLLISION	COMMENTS
15-09692	150427	1215	128	ST	ANCH GAT	RD	5	300	1	1	0	0	1	1	1	1	SB	NB	7	



Attachment C
Maricopa County Assessor

.....

217-01-025A Land Parcel

This is a land parcel located at [12651 E HAPPY VALLEY RD SCOTTSDALE 85255](#). and the current owner is HHL LAND LLC. Its current year full cash value is \$1,966,600.

Property Information

[12651 E HAPPY VALLEY RD SCOTTSDALE 85255](#)

MCR #	19126
Description:	THE GOLDIE BROWN PINNACLE PEAK RANCH UNIT 1 PER M CR 191-26 PARCEL 16 EX N 25F TH/OF (P/F 07-0630157)
Lat/Long	33.71260500|-111.86680542
Lot Size	1,710,125 sq ft.
Zoning	R1-130
Lot #	16
High School District	CAVE CREEK UNIFIED #93
Elementary School District	CAVE CREEK UNIFIED SCHOOL DISTRICT
Local Jurisdiction	SCOTTSDALE
S/T/R	12 4N 5E
Market Area/Neighborhood	07/005
Subdivision (Parcels)	

Owner Information

[HHL LAND LLC](#)

Mailing Address	3003 N CENTRAL AVE UITE 2600, PHOENIX, AZ 85012-2913
Deed Number	121190300
Last Deed Date	12/31/2012
Sale Date	n/a
Sale Price	n/a

Valuation Information

We provide valuation information for the past 5 years. For mobile display, we only show 1 year of valuation information. Should you need more data, please look at our [data sales](#).

The Valuation Information displayed below may not reflect the taxable value used on the tax bill due to any special valuation relief program. [CLICK HERE TO PAY YOUR TAXES OR VIEW YOUR TAX BILL](#)

Tax Year	2019	2018	2017	2016	2015
Full Cash Value	\$1,966,600	\$1,881,100	\$1,881,100	\$2,644,000	\$1,640,600
Limited Property Value	\$553,141	\$526,801	\$501,715	\$477,824	\$455,070
Legal Class	2	2	2	2	2
Description	AG / VACANT LAND / NON-PROFIT R/P				
Assessment Ratio	15%	15%	15%	15%	16%
Assessed FCV	n/a	n/a	n/a	n/a	n/a
Assessed LPV	\$82,971	\$79,020	\$75,257	\$71,674	\$72,811
Property Use Code	0013	0013	0013	0013	0013
PU Description	Vacant Residential Land				
Tax Area Code	931400	931400	931400	931400	931400
Valuation Source	Notice	Notice	Notice	Notice	Notice

Similar Parcels

Parcels that are similar to this one (known as the reference parcel) are displayed below.

APN Address Sale Info FCV Size Livable Sq Ft Year Built Pool Foreclosed

No similar parcels found.



Attachment D Trip Generation

.....



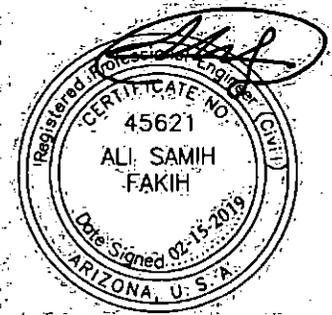
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PRELIMINARY DRAINAGE REPORT
HHL Property – 40 acres
128th Street and Ranch Gate Road
Scottsdale, AZ

Prepared For:

HHL LAND, LLC
1900 MURRAY AVENUE, #203
PITTSBURG, PA 15217

Prepared by:



Sustainability Engineering Group

8280 E. Gelding Drive, Suite 101
Scottsdale, AZ 85260
480.588.7226 www.azSEG.com

Project Number: 180424

Original Submittal Date: AUG 15, 2018

Resubmittal Date: DEC 13, 2018

Revision Date: February 15, 2019

Case No.: 18-ZN-2018

Plan Check No.: TBD

Transmittal Letter

Sustainability Engineering Group

8280 E. Gelding Dr.
 Suite 101
 Scottsdale, AZ 85260
 Phone: 480.588.7226
info@azSEG.com

www.azSEG.com



February 15, 2019

To:
City of Scottsdale
 7447 E. Indian School Road
 Scottsdale, AZ

Attention: One Stop Shop
Re: HHL Land: 18-ZN-2018
Job Number: 180424

We are sending you			
<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> Under Separate Cover via: the following:		
<input type="checkbox"/> Shop Drawings	<input checked="" type="checkbox"/> Prints	<input type="checkbox"/> Plans	<input type="checkbox"/> Other:
<input type="checkbox"/> Copy of Letter	<input type="checkbox"/> Change Order	<input type="checkbox"/> Samples	
<input type="checkbox"/> Total Quantity	<input type="checkbox"/> Reproducible	<input type="checkbox"/> Specification	

Item #	Quantity	Date	DWG. #	Description
1	2	02/15/2019		Preliminary Drainage Report (w/ CD)
2	1	12/11/2018		City Redlines
3	1	12/11/2018		Comment Tracking Log

These are transmitted as checked below		
<input checked="" type="checkbox"/> For Approval	<input type="checkbox"/> Approved as Submitted	<input type="checkbox"/> Resubmit copies for approval
<input type="checkbox"/> For Your Use	<input type="checkbox"/> Approved as Noted	<input type="checkbox"/> Submit [#] copies for distribution
<input type="checkbox"/> As Requested	<input type="checkbox"/> Returned for Corrections	<input type="checkbox"/> Return [#] corrected prints
<input type="checkbox"/> For Review and Comment	<input type="checkbox"/> Revise and Resubmit/Work May Not Proceed	
<input type="checkbox"/> FOR BIDS DUE:	<input type="checkbox"/> PRINTS RETURNED AFTER LOAN	

Comments:

Copy to:

	_____ Signature
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TABLE OF CONTENTS:



COVER SHEET 1

TABLE OF CONTENTS 2,3

1. INTRODUCTION 4

2. LOCATION AND PROJECT DESCRIPTION 4

2.1. LOCATION: 4

2.2. EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE: 4

2.3. EXISTING SITE DESCRIPTION: 4

2.4. PROPOSED SITE DEVELOPMENT: 4

2.5. FLOOD HAZARD ZONE: 5

3. EXISTING DRAINAGE CONDITIONS 5

3.1. OFF-SITE DRAINAGE: 5

3.2. ON-SITE DRAINAGE: 5

3.3. EXISTING RUNOFF RATES: 5

4. PROPOSED STORM WATER MANAGEMENT 6

4.1. DESIGN INTENT: 6

4.2. DESIGN STORM REQUIREMENTS: 6

4.3. CHARACTERISTICS OF BASINS: 6

4.4. STORMWATER RETENTION: 7

4.5. PIPE CAPACITY CALCULATIONS: 9

4.6. STREET CAPACITY AND CURB OPENINGS CALCULATIONS: 9

4.7. STORM DRAIN INLET CALCULATIONS: 9

5. FLOOD SAFETY FOR DWELLING UNITS 10

5.1. FINISHED FLOOR ELEVATIONS: 10

6. CONCLUSIONS 10

6.1. OVERALL PROJECT: 10

6.2. PROJECT PHASING: 10

7. WARNING AND DISCLAIMER OF LIABILITY 10

8. REFERENCES 10

LIST OF FIGURES:

FIGURE 1	-	Vicinity Map
FIGURE 2	-	ESL Map
FIGURE 3	-	Aerial Map
FIGURE 4	-	Offsite Drainage Map
FIGURE 5	-	FIRM

APPENDIX:

APPENDIX I	-	Rainfall Data
APPENDIX II	-	Calculations
APPENDIX III	-	Preliminary Grading & Drainage Plan
APPENDIX IV	-	Wood, Patel Report – Excerpts

1. INTRODUCTION

128th Street and Ranch Gate Road is a 40-acre proposed custom-lot residential subdivision located in the northeastern portion of Scottsdale, Arizona. This parcel is currently undeveloped and covered by typical Sonoran Desert type vegetation. The City of Scottsdale identifies the area of the site as 'Upper Desert' R1 – 130 within Environmentally Sensitive Lands (ESL) as shown on *FIGURE 2 – ESL Classification Map*. The purpose of this report is to support the rezoning application to R1-43 for approximately 33 lots in accordance with the City of Scottsdale zoning ordinance and the environmentally sensitive lands ordinance.

2. LOCATION AND PROJECT DESCRIPTION

2.1 LOCATION:

The project property, herein known as the Site, consists of one (1) parcel of land located on the SWC 128th Street and Ranch Gate Road. It is further defined as being in the Section 11, Township 4 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Scottsdale, Arizona; Parcel ID number is APN: 217-01-025A. Refer to *FIGURE 1 – Vicinity Map* for the Site location with respect to major cross streets.

2.2 EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE:

The Site is bounded by:

- Developed area known as Sereno Canyon to the west
- 128th Street alignment to the east
- Ranch Gate Road alignment to the north
- Juan Tabo Road alignment to the south

2.3 EXISTING SITE DESCRIPTION:

Land ownership includes 39.26 +/- gross acres (35.47 net acres) of undeveloped land. Existing zoning is designated as Single-family Residential, Environmentally Sensitive Lands (R1-130 ESL) per City of Scottsdale Zoning Map 34. Refer to *FIGURE 3 – Aerial Map of the Site*.

The project site lies in the northern corner of the City of Scottsdale with slopes approximately 3.12% from 2,704 feet in the southwest corner to 2,640 feet in the northeast corner. The existing topography of the Site indicates that runoff drains from the southwest to the northeast. Vegetation cover on the Site is typical Sonoran Desert.

No washes on the Site are identified as a 'Vista Corridor' since calculated 100-year, 6-hour flows of washes are less than 750 cfs. Refer to *FIGURE 4 – Offsite Drainage Map and APPENDIX II Existing Drainage Area Map*.

2.4 PROPOSED SITE DEVELOPMENT:

Latest conceptual site plan includes a total of 33 residential lots. Main entry of the property is provided off Ranch Gate Road.



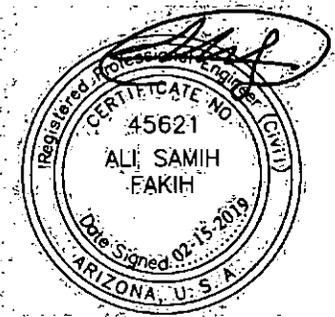
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<input type="checkbox"/> FOR BIDS DUE:	<input type="checkbox"/> PRINTS RETURNED AFTER LOAN	

Comments:

Copy to:

	<p style="text-align: center;">_____ Signature</p>
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COMMENT TRACKING LOG

"LEED®ing and Developing Smart Projects"

CLIENT:	HHL Land	DATE:	02.14.2019
PROJECT:	HHL Ranch Gate	REFERENCE:	2018-12-27 Drainage Report

No.	Sheet No.	Reviewer	COMMENT	Responsible Party	RESPONSE
			The following comments are from City of Scottsdale (G&D Plan)	Nerijus Baronas; 480.312.7072; nbaronas@ScottsdaleAZ.gov	
1	Pg. 1	NB	Tie-In Prop. Contours to existing.	SEG	Contours revised at all ponds
2	Pg. 1	NB	Depict lateral erosion set back	SEG	setback line shown
3	Pg. 1	NB	Depict and call out stormwater volume evacuation means	SEG	stormwater volume is calculated based on 100yr 2hr events for specific drainage areas. Refer to drainage report
4	Pg. 1	NB	Show all proposed grading contours associated with development infrastructure.	SEG	new contours have been added
5	Pg. 1	NB	See dashed lines on top right space.	SEG	fixed
6	Pg. 1	NB	Add section (See arrowed line)	SEG	section has been added
7	Pg. 1	NB	See dashed line across drawings	SEG	fixed
8	Pg. 1	NB	Add call out, see drawn in lines)	SEG	call out added
9	Pg. 1	NB	Add section (see drawn in lines)	SEG	section has been added
10	Pg. 1	NB	Is this 1/2 foot contour? Please depict, label and tie-in to ex. All proposed contours. (Typ)	SEG	1' contours added
11	Pg. 1	NB	Add call out (see arrow)	SEG	call out added
12	Pg. 1	NB	Add call out (see arrow)	SEG	call out added
13	Pg. 1	NB	Depict all proposed grading label flow line and design flows	SEG	fixed
14	Pg. 1	NB	Depict and label lateral erosion setbacks (See arrows)	SEG	erosion setback line shown
			The following comments are from City of Scottsdale (Drainage Report)		
1	Pg. 25		page is upside down.	SEG	Corrected

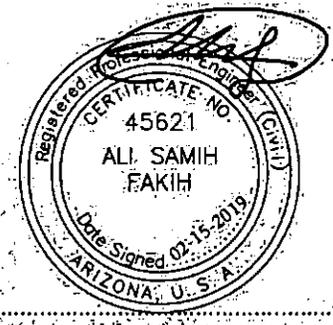


COMMENT TRACKING LOG

"LEED®ing and Developing Smart Projects"

2	Pg. 28		AREA 3 (AC)	SEG	Added
3	Pg. 28		AREA (AC)	SEG	Added
4	Pg. 28		AREA (AC)	SEG	Added
5	Pg. 38		Update channel stations to true bank locations	SEG	added / revised stations
6			Expand sections as needed to achieve containment	SEG	revised
7			Submit digital H&H models.	SEG	included with submittal

TABLE OF CONTENTS:



COVER SHEET	1
TABLE OF CONTENTS	2,3
1. INTRODUCTION	4
2. LOCATION AND PROJECT DESCRIPTION	
2.1. LOCATION:	4
2.2. EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE:	4
2.3. EXISTING SITE DESCRIPTION:	4
2.4. PROPOSED SITE DEVELOPMENT:	4
2.5. FLOOD HAZARD ZONE:	5
3. EXISTING DRAINAGE CONDITIONS	
3.1. OFF-SITE DRAINAGE:	5
3.2. ON-SITE DRAINAGE:	5
3.3. EXISTING RUNOFF RATES:	5
4. PROPOSED STORM WATER MANAGEMENT	
4.1. DESIGN INTENT:	6
4.2. DESIGN STORM REQUIREMENTS:	6
4.3. CHARACTERISTICS OF BASINS:	6
4.4. STORMWATER RETENTION:	7
4.5. PIPE CAPACITY CALCULATIONS:	9
4.6. STREET CAPACITY AND CURB OPENINGS CALCULATIONS:	9
4.7. STORM DRAIN INLET CALCULATIONS:	9
5. FLOOD SAFETY FOR DWELLING UNITS	
5.1. FINISHED FLOOR ELEVATIONS:	10
6. CONCLUSIONS	
6.1. OVERALL PROJECT:	10
6.2. PROJECT PHASING:	10
7. WARNING AND DISCLAIMER OF LIABILITY	10
8. REFERENCES	10

LIST OF FIGURES:

FIGURE 1	-	Vicinity Map
FIGURE 2	-	ESL Map
FIGURE 3	-	Aerial Map
FIGURE 4	-	Offsite Drainage Map
FIGURE 5	-	FIRM

APPENDIX:

APPENDIX I	-	Rainfall Data
APPENDIX II	-	Calculations
APPENDIX III	-	Preliminary Grading & Drainage Plan
APPENDIX IV	-	Wood, Patel Report – Excerpts

1. INTRODUCTION

128th Street and Ranch Gate Road is a 40-acre proposed custom-lot residential subdivision located in the northeastern portion of Scottsdale, Arizona. This parcel is currently undeveloped and covered by typical Sonoran Desert type vegetation. The City of Scottsdale identifies the area of the site as 'Upper Desert' R1-130 within Environmentally Sensitive Lands (ESL) as shown on *FIGURE 2 – ESL Classification Map*. The purpose of this report is to support the rezoning application to R1-43 for approximately 33 lots in accordance with the City of Scottsdale zoning ordinance and the environmentally sensitive lands ordinance.

2. LOCATION AND PROJECT DESCRIPTION

2.1 LOCATION:

The project property, herein known as the Site, consists of one (1) parcel of land located on the SWC 128th Street and Ranch Gate Road. It is further defined as being in the Section 11, Township 4 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Scottsdale, Arizona; Parcel ID number is APN: 217-01-025A. Refer to *FIGURE 1 – Vicinity Map* for the Site location with respect to major cross streets.

2.2 EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE:

The Site is bounded by:

- Developed area known as Sereno Canyon to the west
- 128th Street alignment to the east
- Ranch Gate Road alignment to the north
- Juan Tabo Road alignment to the south

2.3 EXISTING SITE DESCRIPTION:

Land ownership includes 39.26 +/- gross acres (35.47 net acres) of undeveloped land. Existing zoning is designated as Single-family Residential, Environmentally Sensitive Lands (R1-130 ESL) per City of Scottsdale Zoning Map 34. Refer to *FIGURE 3 – Aerial Map* of the Site.

The project site lies in the northern corner of the City of Scottsdale with slopes approximately 3.12% from 2,704 feet in the southwest corner to 2,640 feet in the northeast corner. The existing topography of the Site indicates that runoff drains from the southwest to the northeast. Vegetation cover on the Site is typical Sonoran Desert.

No washes on the Site are identified as a 'Vista Corridor' since calculated 100-year, 6-hour flows of washes are less than 750 cfs. Refer to *FIGURE 4 – Offsite Drainage Map and APPENDIX II Existing Drainage Area Map*.

2.4 PROPOSED SITE DEVELOPMENT:

Latest conceptual site plan includes a total of 33 residential lots. Main entry of the property is provided off Ranch Gate Road.

2.5 FLOOD HAZARD ZONE:

As defined by the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona, and Incorporated Areas, Panel number 1335 of 4350, as shown on Map Number 04013C1335M dated November 4th, 2015, the Site is designated as **Zone 'D'**. The definition of **Zone 'D'** by the FEMA indicates that the area lies in a zone of possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. Refer to *FIGURE 5-FIRM*.

3. EXISTING DRAINAGE CONDITIONS**3.1 OFF-SITE DRAINAGE:**

Off-site drainage that would impact the Site is within the development known as Sereno Canyon. It affects the Site to southwest corner. These off-site areas which impact the on-site drainage are currently undeveloped. Refer to Appendix IV for excerpts of approved Wood, Patel report for flows.

3.2 ON-SITE DRAINAGE:

Existing condition of the Site is undeveloped desert landscape sloping from southwest to northeast. The historical outlets are mainly placed along the northern and eastern boundary of property lines. Existing onsite drainage sub basin boundaries were identified using 2-foot contour mapping provided by the City of Scottsdale. Refer to previous drainage report (*Preliminary Drainage Report For 128th Street and Ranch Gate Road, Wood, Patel & Associates, Inc.*), and *APPENDIX II – Existing Drainage Area Map*. Onsite runoff is conveyed across the site via overland flow. Washes 1, 2, 3, and 4 are washes with flow greater than 50 cfs in a 100-year, 6-hour peak flow condition. These washes traverse the Site to the northeast corner and exit the Site at the property boundary. Excluding washes conveying flows over 50 cfs, onsite minor washes with flow less than 50 cfs in a 100-year, 6-hour storm event traverse northeasterly until they exit outside of the property. Delineation of the 100-year, 6-hour water surface extents for washes with flow rate 50 cfs or more has been presented based on HEC-RAS modeling and Water surface elevations for each wash as shown in *APPENDIX II*.

3.3 EXISTING RUNOFF RATES:

Referring to the previous drainage report, there are total of nine (9) historical outflow points along 128th Street and Ranch Gate Road that will have developed discharge rates maintained at or below existing conditions. Summary of existing discharge points flow rate are following:

- CP 1-OUT: 176 CFS
- CP 2-OUT: 3 CFS
- CP 3-OUT: 6 CFS
- CP 4-OUT: 413 CFS
- CP 5-OUT: 71 CFS
- CP 6-OUT: 2 CFS
- CP 7-OUT: 4 CFS
- CP 8-OUT: 182 CFS
- CP 9-OUT: 2 CFS

4. PROPOSED STORM WATER MANAGEMENT

4.1 DESIGN INTENT:

In accordance with City of Scottsdale, *Design Standards and Policies Manual*, on-site retention shall be provided to store runoff from rainfall events up to and including the 100-year, 2-hour duration event for sites that have not been previously developed.

The main purpose of the proposed drainage design is to provide pre-development vs. post-development flow attenuation along the major washes for the 100-year peak flows.

For all existing control points (CP 1-OUT through CP 9-OUT) established at 128th Street and Ranch Gate Road concentrated flow areas, the proposed runoff rates will be limited to a maximum of the existing runoff rates and stormwater storage upstream of the control points will be based on the proposed conditions area conveyed to each point. Small areas currently conveyed off-site to the north and south will be directed on site to contribute to associated control points.

4.2 DESIGN STORM REQUIREMENTS:

The on-site hydrology will be completed during the final design using the rational method in accordance with the City Manual and the FCDMC Manual during final engineering. The site is in an ESL zone and is currently undeveloped and will require storage for the 100-yr 2-hr storm event based on the proposed conditions C_{wt} vs existing conditions C_{wt} of the disturbed areas. The ultimate goal of the design is to control proposed off-site discharge to not greater than the existing flows.

4.3 CHARACTERISTICS OF DRAINAGE AREA:

Based on DS&PM, runoff coefficients for the 100-year storm event used are as follows:

- $C=0.45$ for undisturbed natural desert or desert landscape
- $C=0.61$ for the lots in R1-43 zones
- $C=0.95$ for R.O.W areas.

HYDROLOGIC ANALYSIS: The hydrologic analysis is determined using the procedures in the City of Scottsdale Design Standards & Policies Manual and the Drainage Design Manual for Maricopa County, Arizona, Volume I. The Rational Method was utilized to compute the on-site peak discharges. The following established the Rational Method equation and the basic input data required:

$$Q=C_{wt}IA$$

Where:

- C_{wt} = The runoff coefficient relating runoff to rainfall
- I = Average rainfall intensity in inches/hour, lasting for T_c
- T_c = The time of concentration (minutes)
- A = The contributing drainage area in acres

The Site has been proposed to be a 33-lot residential area. Based on the preliminary grading plan, 17 drainage areas are developed to separate the storm runoff. The runoff coefficients for drainage areas and the rainfall data can be found to *APPENDIX II*.

The following table indicates the proposed drainage areas that contribute runoff to the outlets:

Outlet	Drainage Area ID
CP 1-OUT	DA1; Inlet 1-1, Inlet 1-2
CP 4-OUT	DA5, DA5A; Inlet 2-1, Inlet 2-2, Inlet 2-3
CP 5-OUT	DA10, DA11A, Inlet 2-4; Inlet 3-1, Inlet 3-2
CP 8-OUT	DA14; Inlet 4-1

Based on the table provided above, the historical outlets' flow rate in proposed condition are summarized below:

Historical Outlet	Proposed Q100 (cfs)	Existing Q100 (cfs)
CP 1-OUT	174	176
CP 2-OUT	0	3
CP 3-OUT	0	6
CP 4-OUT	366	413
CP 5-OUT	57	71
CP 6-OUT	0	2
CP 7-OUT	0	4
CP 8-OUT	179	182
CP 9-OUT	0	2

Referring to *APPENDIX II-Proposed Drainage Area Map and Proposed and Existing Drainage Calculation*. Based on the above summary, the post development flows are less than the existing conditions.

4.4 STORMWATER RETENTION:

First Flush storage required is calculated in accordance with COS- DS&PM. Required Retention (Acre-Feet) = $(0.5"/12) * A * (C_{wt})$.

100-Yr, 2-hour stormwater storage required is calculated by pond rounding method in accordance with the COS - DS&PM. Refer to Appendix II for calculations and results. Required Retention (Acre-Feet) = $(P/12) * A * (C_{wt})$.

Where: P = 100 Yr. 2 Hr. Precipitation in Inches (Ref: Isopluvial from DS&PM, Appendix 4-1D, pg. 11 and NOAA-Atlas 14 table)
 A = Area (Acres)
 C = C_{wt} (See Appendix II for calculation)

4.4.1 REQUIRED STORAGE:

Required storage for the 100-yr 2-hr storm will be calculated using three methods as follows:

- Calculate based on full 100-yr 2-hr storage (post vs existing of disturbed areas)
- Calculate based on pre- versus. Post- flow rate (using existing conditions as allowable outflow).
- Calculate First Flush

- Per DS&PM requirements, HEC-1 Modeling will be provided in subsequent submittals for the 2-yr, 10-yr, and 100-yr events.

Required First Flush:

Required storage is calculated in accordance with City of Scottsdale requirements as follows:

- First Flush = $0.5/12 * \text{Area} * 0.61$

The following table shows the required volume of first flush for each basin:

First Flush for each Basin		
Basin Number	Area (ac)	First flush volume (CF)
Basin 1	5.90	6532
Basin 2	4.52	5004
Basin 3	0.71	786
Basin 4	0.93	1030
Basin 5	0.33	365
	Total	13718

REQUIRED STORAGE BASED ON FULL RETENTION OF 100-yr 2-hr STORM EVENT:

In accordance with the COS-DS&PM, the 100-yr, 2-hour stormwater storage required (proposed vs. existing) is calculated by: $V_r = (P/12) * A * C_{wt}$

Because the site is currently undeveloped, the required storage volume should be calculated under full 100-year, 2-hour storm event storage volume.

$A = 14.88 \text{ ac (disturbed area); } C_{wt} = 0.61 \text{ (Based on R-43 Zoning)}$

$V_r = 2.71/12 * 14.88 \text{ AC} * 0.61 = 2.05 \text{ ac. ft. (89,291.20 c.f.)}$

REQUIRED STORAGE BASED ON PRE VS. POST-DEVELOPMENT FLOW RATES:

Basin 2:

Allowable release rate at CP 4-OUT:

- Off-site flow: 349 cfs
- On-Site flow generated from drainage areas: 17 cfs
- Sub-Total flow to culvert: 366 cfs

Allowable release from detention basin (Basin 2) = 413 cfs existing – 366 by-pass = 47 cfs

Area to basin = 8.33 ac

Using the modified pond routing method (previously approved by the COS), the following summary indicates the calculated required storage volume where:

- 100-yr, 2-hr pond routing retention volume calculation is shown in Appendix II using the following equation:

$$V_r = (Q_{in} - Q_{out}) * T_c * 60$$

Where: V_r = Required storage volume

$$Q_{in} = C_{wt} * I * A_{(disturbed)}$$

$$Q_{out} = 0.45 * I_{(15\ min)} * A_{(disturbed)}$$

T_c = Time of Concentration

Refer to Appendix II for the pond routing calculations.

4.4.2 PROPOSED STORAGE

Open retention basins will be used for this project. In accordance with COS design requirements, an open basin is limited to three (3) feet maximum depth with maximum side slopes of 4:1 (6:1 near streets) with one (1) foot freeboard and include an emergency overflow outlet:

- The volume for open basins is calculated using the area-sum volume method based on design contours.

A summary of preliminary available retention follows:

PROVIDED RETENTION VOLUME SUMMARY		REQUIRED RETENTION VOLUME SUMMARY	
BASIN ID	VOLUME PROVIDED (C.F.)	BASIN ID	VOLUME REQUIRED (C.F.)
1	42,721	1	42,167
2	38,647	2	36,708
3	4,164	3	3,607
4	6,790	4	4,819
5	4,963	5	1,618
TOTAL	97,284	TOTAL	88,919

The above summary indicated there is 97,284 c.f. of storage volume available. 97,284 c.f. available is larger than 88,919 c.f. required. In this design, required volumes for Basin 2 is calculated based on pond routing, Basin 1, 3, 4, and 5 are calculated based on full 100yr, 2hr storm events. Refer to Appendix II for individual basin volume calculations.

4.4.3 STORAGE DISCHARGE:

The discharge facilities of all basins will be designed in accordance with City of Scottsdale requirements using drywells or bleed-off pipes to provide total discharge within 36 hours. Geotechnical testing for percolation rates of the native soils will be completed to verify, if adequate infiltration is available for proposed discharge assumptions. The number of proposed drywells will be adjusted (up or down) as required to meet design requirements.

4.5 PIPE CAPACITY CALCULATIONS:

These calculations will be provided in the Final Drainage Report.

4.6 STREET CAPACITY CALCULATIONS AND CURB OPENINGS:

These calculations will be provided in the Final Drainage Report.

4.7 STORM DRAIN INLET CALCULATIONS:

These calculations will be provided in the Final Drainage Report.

5. FLOOD SAFETY FOR DWELLINGS

5.1 FINISHED FLOOR ELEVATIONS

All proposed building finished floor elevations will be set a minimum of 14 inches above emergency overflow points which will either be the low side top of curb elevation or natural points on the perimeter of the lots. Finished Floors will also be set a minimum of 12 inches above the 100-year high-water elevation of any adjacent streets and drainage paths. This will ensure that each building will be well above the 100-year water level.

Erosion setback requirements have been calculated and shown on the grading exhibit. Building will be sited and/or walls will be located as required for protection from potential impacts of erosion. Refer to Appendix II for calculations.

6. CONCLUSIONS

6.1 OVERALL PROJECT:

1. FEMA Zone code "D" is assigned as shown on *FIGURE 5 – Flood Insurance Rate Map (FIRM)*.
2. Four major washes which convey flows over 50 cfs will be maintained in their original location and conditions.
3. Drainage corridors will be designated for the minor flows along the property in accordance with proper ordinance requirements from City of Scottsdale.
4. Storm water storage will be provided for 100-year, 2-hour storm water event and will discharge within 36 hours in accordance with City of Scottsdale requirements.
5. The finish floor elevations will be designed a minimum of 1 foot above the 100-year water surface in adjacent streets and drainage paths and a minimum of 14 inches above the low top of curb of the lot.
6. Maintenance is required for all drainage systems to assure design performance.

6.2 PROJECT PHASING:

As a residential development, the infrastructure may be constructed in a single phase to accommodate dwelling unit growth. The dwelling units will be phased based on consumer demand.

7. WARNING AND DISCLAIMER OF LIABILITY

RE: following page.

8. REFERENCES

1. *Design Standards & Policies Manual, City of Scottsdale – 2018*
2. *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology, Flood Control District of Maricopa County, Fourth Edition, August 15, 2013*
3. *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics, Flood Control District of Maricopa County, August 15, 2013*
4. *Preliminary Drainage Report For 128th Street and Ranch Gate Road, Wood, Patel & Associates, Inc., January 9, 2009*

GRADING & DRAINAGE LANGUAGE

WARNING AND DISCLAIMER OF LIABILITY

The City's Stormwater and Floodplain Management Ordinance is intended to minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding. The Stormwater and Floodplain Management Ordinance identifies floodplains, floodways, flood fringes and special flood hazard areas. However, a property outside these areas could be inundated by floods. Also, much of the city is a dynamic flood area; floodways, floodplains, flood fringes and special flood hazard areas may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY

The flood protection provided by the Stormwater and Floodplain Management Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by constructed or natural causes. The Stormwater and Floodplain Management Ordinance does not create liability on the part of the city, any officer or employee thereof, or the federal, state or county government for any flood damages that result from reliance on the Ordinance or any administrative decision lawfully made thereunder.

Compliance with the Stormwater and Floodplain Management Ordinance does not ensure complete protection from flooding. Flood-related problems such as natural erosion, streambed meander, or constructed obstructions and diversions may occur and have an adverse effect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

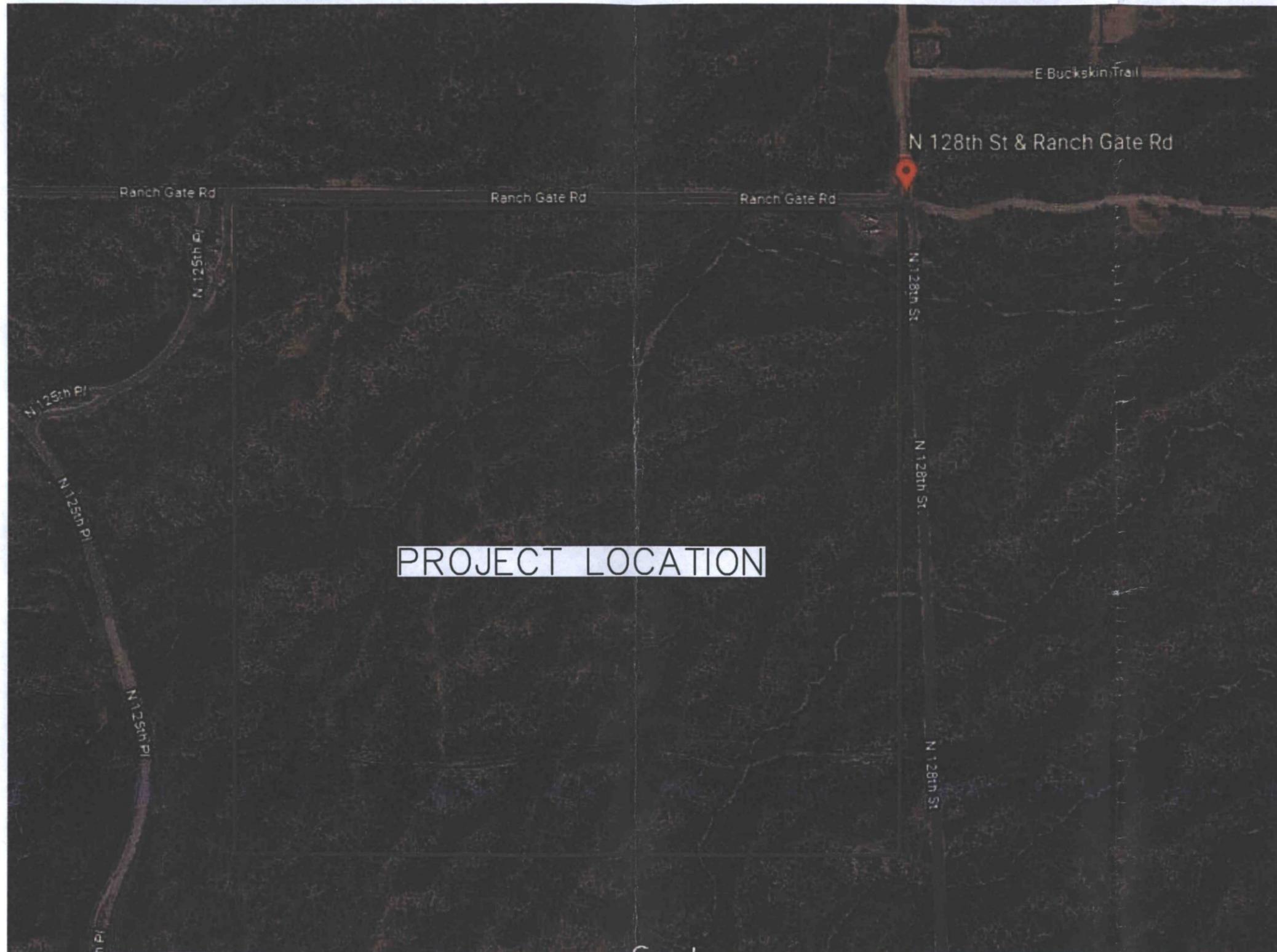
I have read and understand the above.

Plan Check #

Owner

Date

FIGURE 1



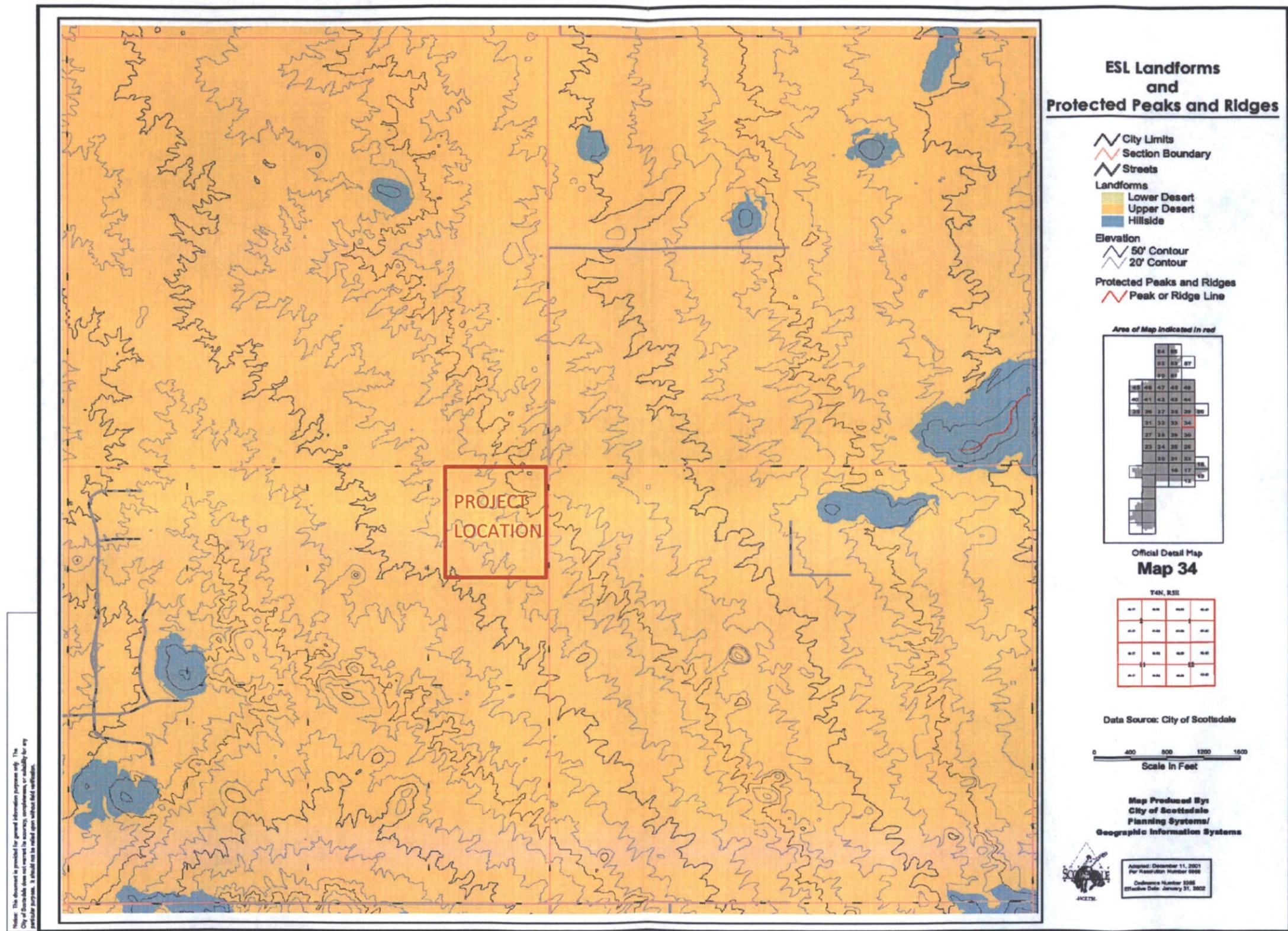


FIGURE 2 ESL MAP

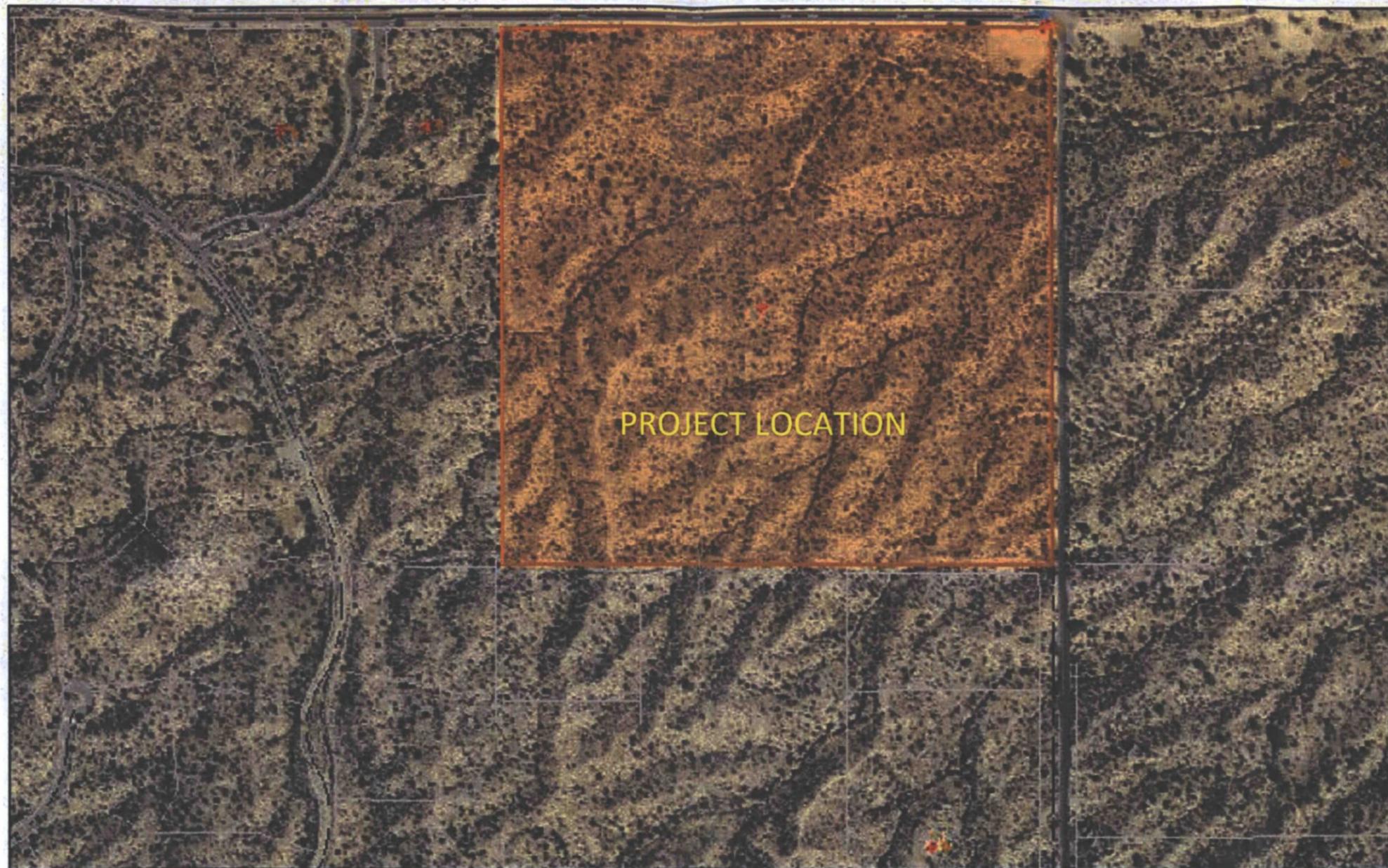
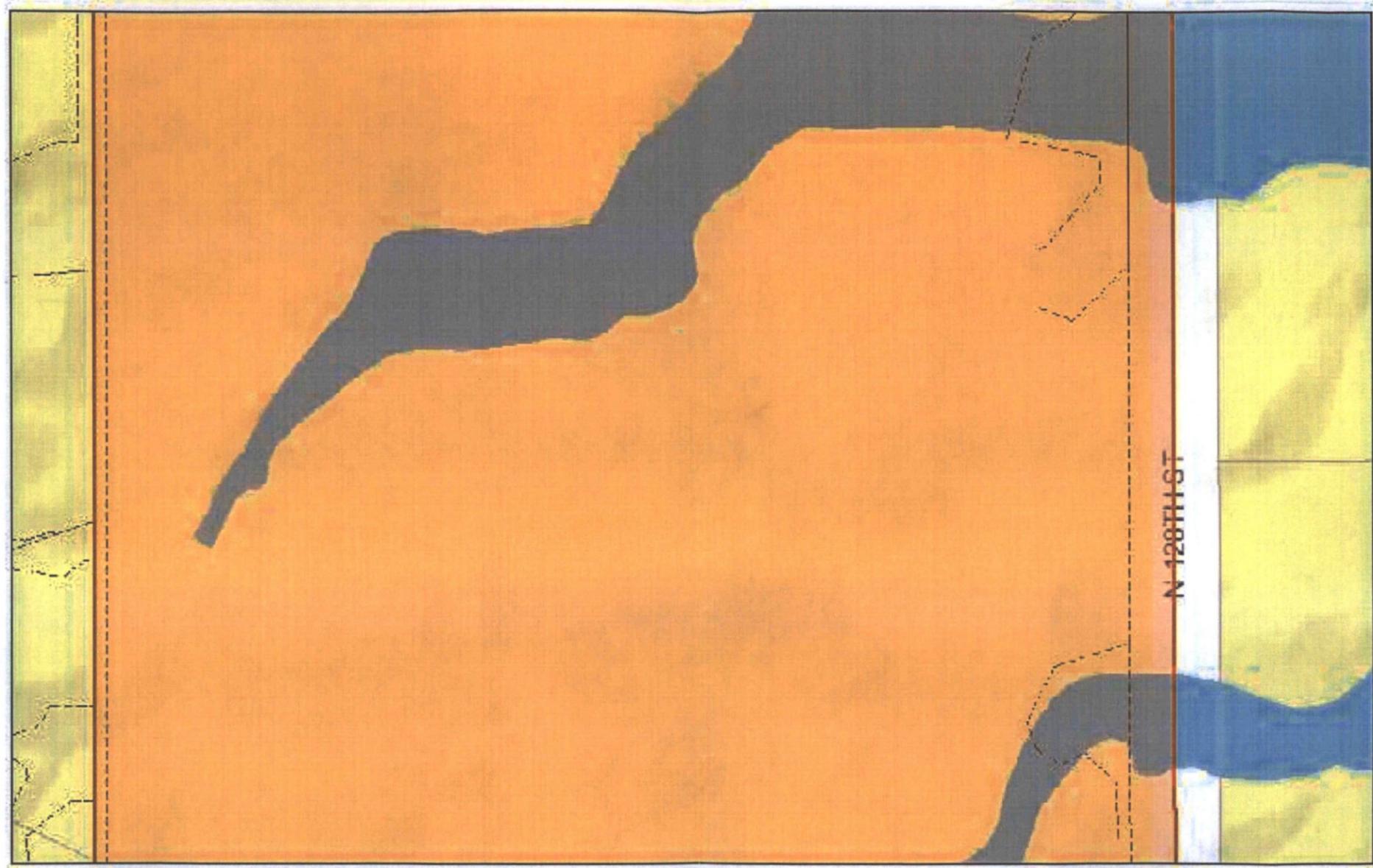
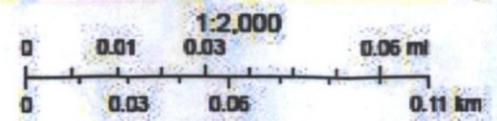


Figure 3
Aerial Map



August 14, 2018

- Override 1
- Large Washes - 50cfs
- Easement Leaders
- NAOS Leaders
- Zoning
- Parcel Boundary
- Street Centerlines
- Easement
- GLO
- NAOS



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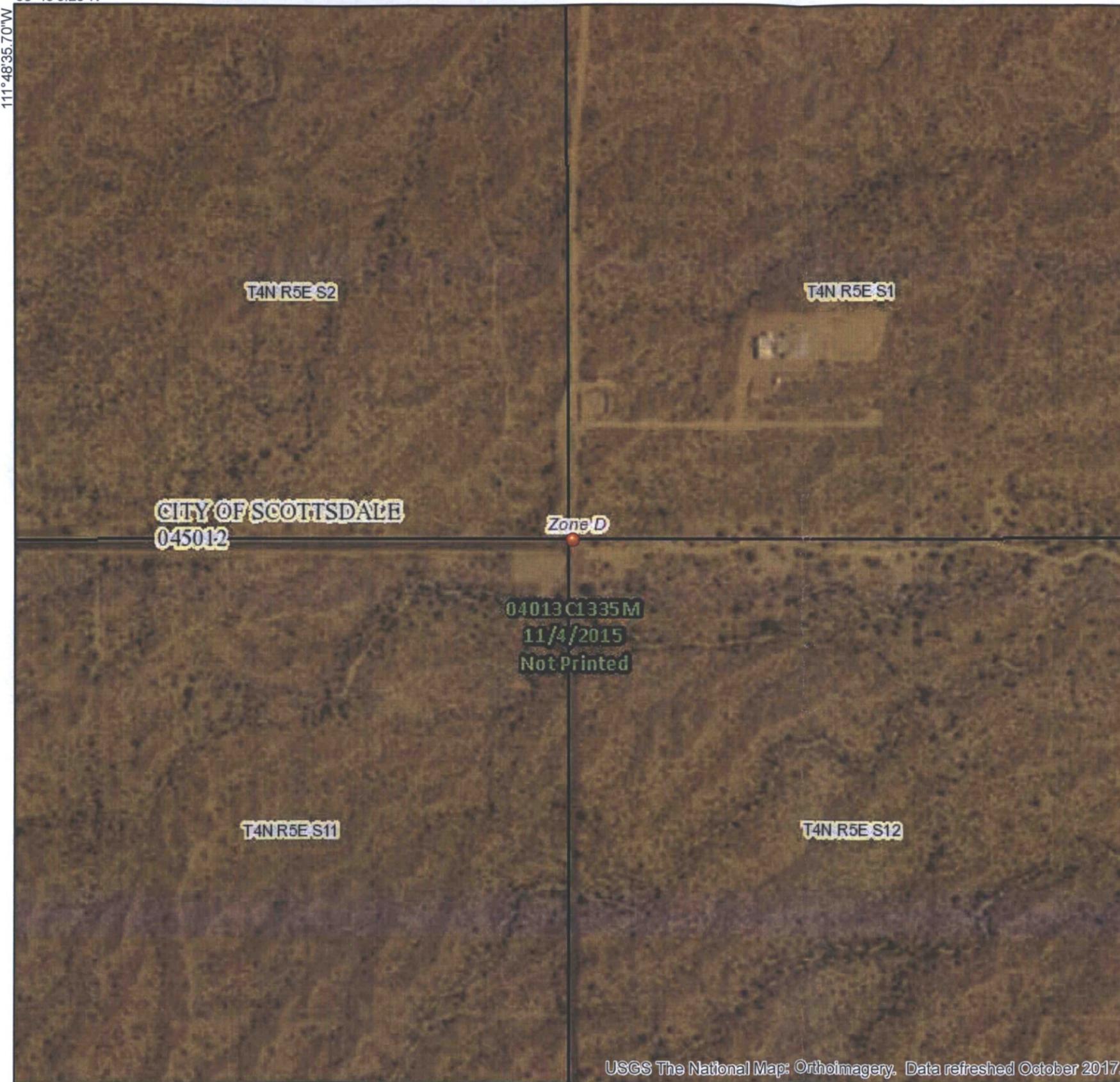
Figure 4
Offsite Drainage Map

National Flood Hazard Layer FIRMette



33°43'0.28"N

111°48'35.70"W



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- | | | |
|-----------------------------|--|---|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
Zone A, V, A99 |
| | | With BFE or Depth Zone AE, AO, AH, VE, AR |
| | | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X |
| | | Future Conditions 1% Annual Chance Flood Hazard Zone X |
| | | Area with Reduced Flood Risk due to Levee. See Notes. Zone X |
| | | Area with Flood Risk due to Levee Zone D |
| OTHER AREAS | | Area of Minimal Flood Hazard Zone X |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard Zone D |
| | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2
17.5
Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| MAP PANELS | | Profile Baseline |
| | | Hydrographic Feature |
| | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |
- The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/13/2018 at 7:19:41 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

0 250 500 1,000 1,500 2,000 Feet 1:6,000

33°42'30.35"N

111°47'58.24"W

Figure 5 FIRM



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APPENDIX I
Rainfall Data



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.71°, Longitude: -111.8°
Elevation: 2616.82 ft**



* source: ESRI Maps
 ** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.241 (0.201-0.298)	0.315 (0.264-0.390)	0.425 (0.350-0.522)	0.506 (0.414-0.619)	0.612 (0.494-0.746)	0.691 (0.552-0.839)	0.771 (0.605-0.933)	0.849 (0.658-1.03)	0.953 (0.720-1.16)	1.03 (0.765-1.26)
10-min	0.367 (0.306-0.453)	0.480 (0.401-0.593)	0.646 (0.533-0.794)	0.770 (0.630-0.942)	0.932 (0.752-1.14)	1.05 (0.840-1.28)	1.17 (0.922-1.42)	1.29 (1.00-1.56)	1.45 (1.10-1.76)	1.57 (1.17-1.92)
15-min	0.455 (0.379-0.562)	0.595 (0.497-0.735)	0.801 (0.661-0.985)	0.954 (0.781-1.17)	1.16 (0.932-1.41)	1.30 (1.04-1.58)	1.45 (1.14-1.76)	1.60 (1.24-1.94)	1.80 (1.36-2.18)	1.95 (1.44-2.38)
30-min	0.613 (0.510-0.756)	0.802 (0.669-0.990)	1.08 (0.890-1.33)	1.29 (1.05-1.57)	1.56 (1.26-1.90)	1.76 (1.40-2.13)	1.96 (1.54-2.37)	2.16 (1.67-2.61)	2.42 (1.83-2.94)	2.63 (1.95-3.20)
60-min	0.759 (0.632-0.936)	0.992 (0.828-1.23)	1.34 (1.10-1.64)	1.59 (1.30-1.95)	1.93 (1.55-2.35)	2.17 (1.74-2.64)	2.42 (1.90-2.93)	2.67 (2.07-3.23)	3.00 (2.27-3.63)	3.25 (2.41-3.96)
2-hr	0.871 (0.731-1.05)	1.13 (0.948-1.36)	1.50 (1.25-1.80)	1.77 (1.47-2.14)	2.15 (1.76-2.57)	2.43 (1.96-2.90)	2.71 (2.16-3.24)	3.00 (2.35-3.57)	3.37 (2.59-4.01)	3.66 (2.75-4.39)
3-hr	0.933 (0.784-1.14)	1.20 (1.01-1.47)	1.56 (1.30-1.91)	1.84 (1.53-2.25)	2.24 (1.83-2.72)	2.55 (2.06-3.08)	2.87 (2.28-3.47)	3.20 (2.50-3.86)	3.65 (2.77-4.40)	4.02 (2.97-4.84)
6-hr	1.13 (0.971-1.34)	1.43 (1.23-1.69)	1.81 (1.55-2.14)	2.11 (1.79-2.49)	2.53 (2.12-2.97)	2.85 (2.35-3.34)	3.19 (2.59-3.73)	3.52 (2.82-4.13)	3.97 (3.09-4.64)	4.31 (3.29-5.04)
12-hr	1.36 (1.18-1.59)	1.71 (1.48-2.00)	2.15 (1.85-2.50)	2.50 (2.14-2.91)	2.97 (2.52-3.45)	3.33 (2.79-3.86)	3.71 (3.06-4.29)	4.08 (3.33-4.72)	4.57 (3.64-5.31)	4.94 (3.87-5.78)
24-hr	1.67 (1.47-1.91)	2.12 (1.88-2.43)	2.76 (2.43-3.16)	3.27 (2.87-3.75)	4.00 (3.47-4.59)	4.59 (3.94-5.26)	5.21 (4.42-6.01)	5.87 (4.90-6.80)	6.79 (5.56-7.95)	7.54 (6.06-8.91)
2-day	1.92 (1.69-2.21)	2.46 (2.16-2.82)	3.25 (2.84-3.72)	3.89 (3.39-4.45)	4.80 (4.14-5.50)	5.54 (4.72-6.36)	6.32 (5.33-7.30)	7.16 (5.96-8.32)	8.34 (6.80-9.79)	9.30 (7.46-11.0)
3-day	2.08 (1.83-2.38)	2.67 (2.35-3.05)	3.55 (3.11-4.06)	4.28 (3.73-4.88)	5.32 (4.60-6.08)	6.18 (5.28-7.07)	7.10 (6.00-8.17)	8.08 (6.74-9.38)	9.50 (7.75-11.1)	10.7 (8.55-12.6)
4-day	2.23 (1.97-2.55)	2.87 (2.53-3.28)	3.86 (3.39-4.39)	4.67 (4.08-5.31)	5.84 (5.06-6.65)	6.81 (5.84-7.79)	7.87 (6.67-9.04)	9.01 (7.51-10.4)	10.7 (8.70-12.5)	12.0 (9.65-14.2)
7-day	2.57 (2.25-2.95)	3.30 (2.89-3.79)	4.44 (3.88-5.10)	5.39 (4.68-6.19)	6.78 (5.82-7.78)	7.93 (6.75-9.14)	9.19 (7.72-10.6)	10.6 (8.74-12.4)	12.6 (10.2-14.8)	14.2 (11.3-17.0)
10-day	2.82 (2.48-3.22)	3.63 (3.20-4.14)	4.86 (4.26-5.54)	5.87 (5.12-6.70)	7.34 (6.34-8.38)	8.56 (7.32-9.80)	9.88 (8.35-11.4)	11.3 (9.42-13.1)	13.4 (10.9-15.7)	15.1 (12.1-17.9)
20-day	3.58 (3.16-4.08)	4.62 (4.08-5.25)	6.14 (5.40-6.98)	7.34 (6.42-8.34)	9.01 (7.82-10.2)	10.3 (8.88-11.8)	11.7 (9.99-13.5)	13.2 (11.1-15.2)	15.2 (12.6-17.8)	16.9 (13.8-19.9)
30-day	4.25 (3.75-4.83)	5.49 (4.85-6.23)	7.30 (6.43-8.26)	8.71 (7.64-9.85)	10.7 (9.28-12.1)	12.2 (10.5-13.8)	13.8 (11.8-15.7)	15.5 (13.1-17.7)	17.8 (14.8-20.6)	19.6 (16.1-22.9)
45-day	5.09 (4.49-5.78)	6.59 (5.81-7.47)	8.75 (7.70-9.92)	10.4 (9.13-11.8)	12.7 (11.1-14.4)	14.5 (12.5-16.5)	16.4 (14.0-18.8)	18.3 (15.5-21.2)	21.1 (17.5-24.6)	23.3 (19.1-27.4)
60-day	5.79 (5.12-6.56)	7.52 (6.64-8.50)	9.95 (8.77-11.3)	11.8 (10.3-13.4)	14.2 (12.4-16.2)	16.1 (14.0-18.4)	18.1 (15.5-20.7)	20.1 (17.1-23.2)	22.9 (19.2-26.7)	25.1 (20.7-29.5)

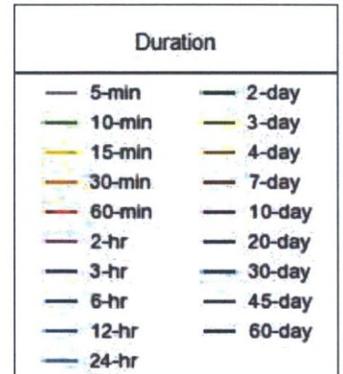
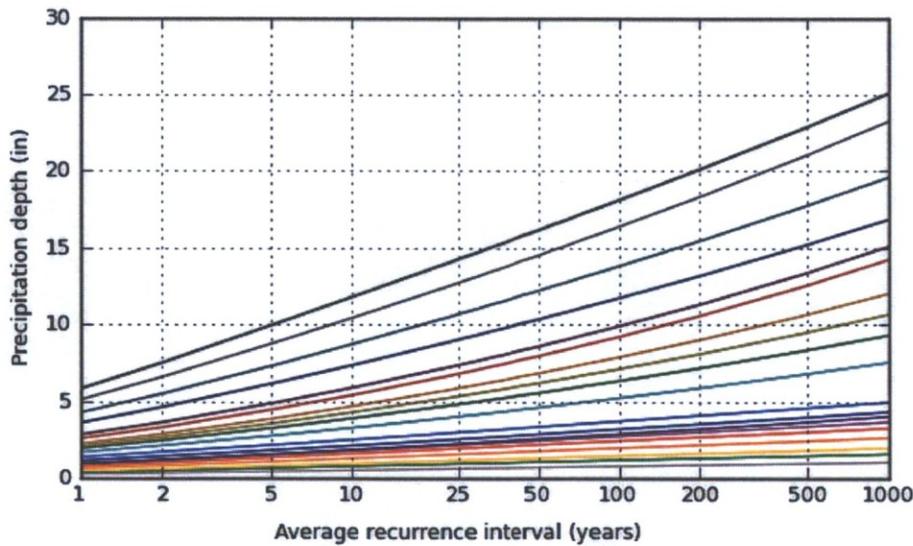
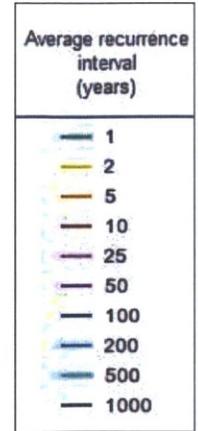
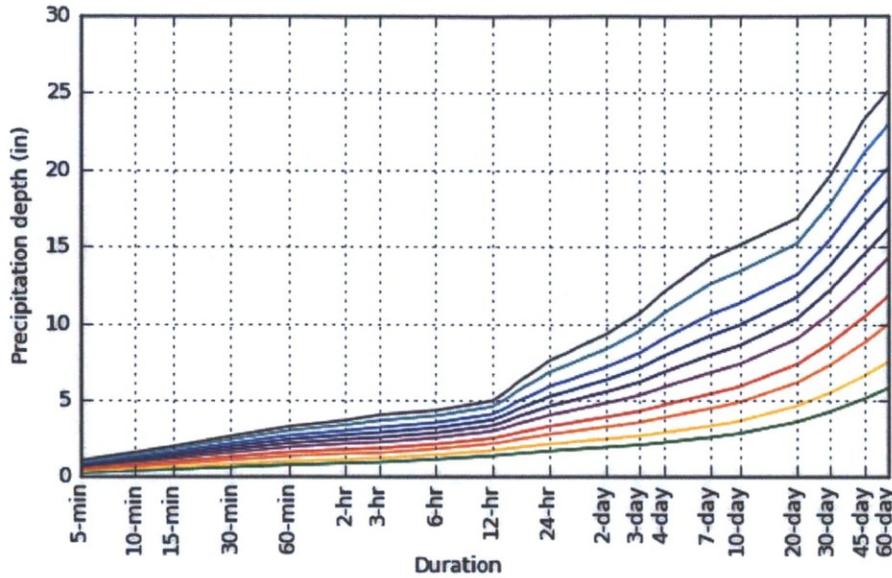
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 33.7100°, Longitude: -111.8000°



[Back to Top](#)

Maps & aerials

Small scale terrain



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.71°, Longitude: -111.8°
Elevation: 2616.82 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

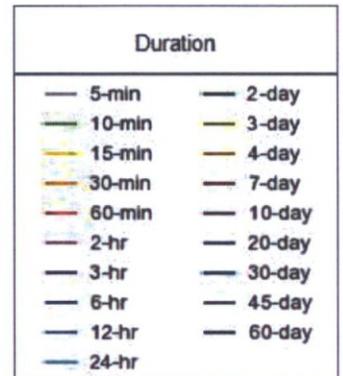
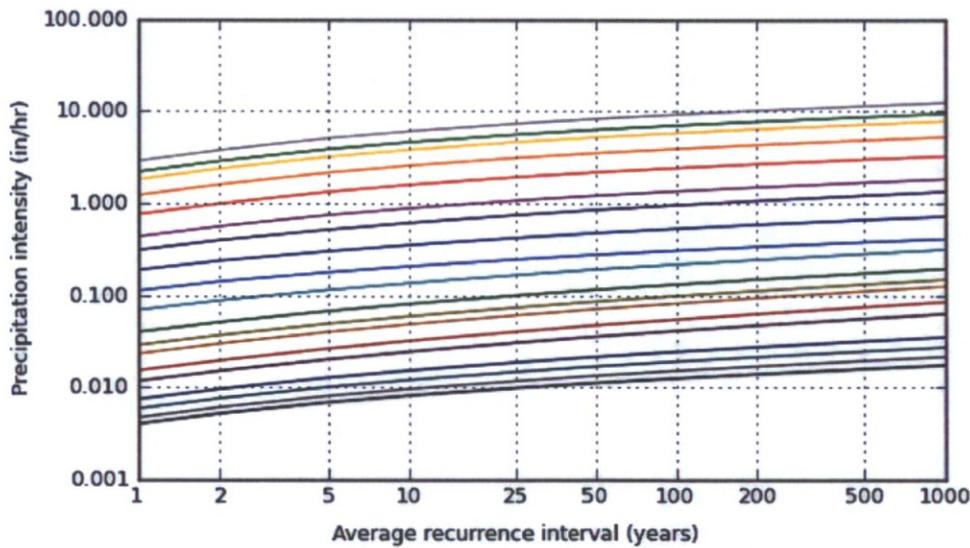
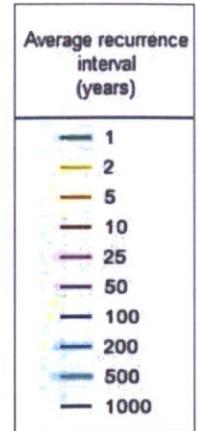
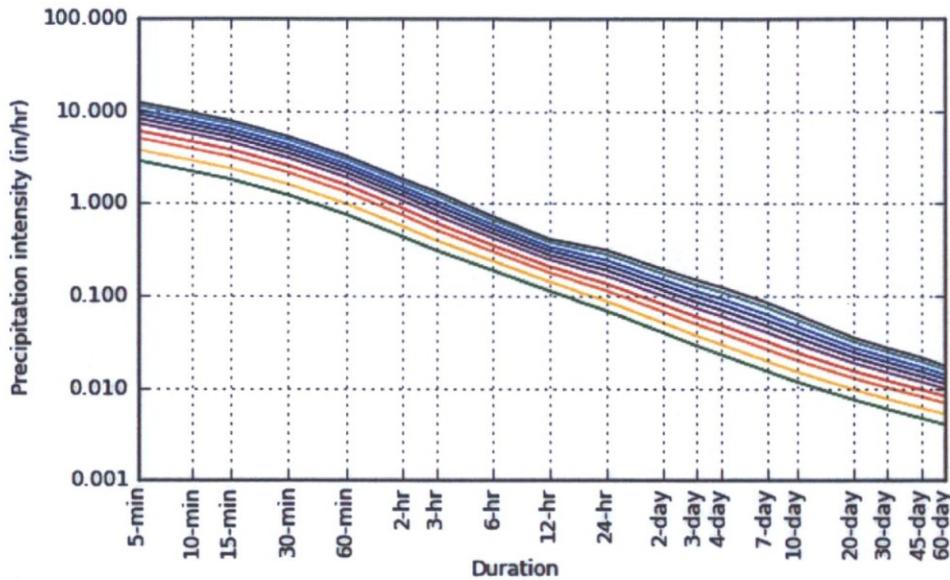
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.89 (2.41-3.58)	3.78 (3.17-4.68)	5.10 (4.20-6.26)	6.07 (4.97-7.43)	7.34 (5.93-8.95)	8.29 (6.62-10.1)	9.25 (7.26-11.2)	10.2 (7.90-12.3)	11.4 (8.64-13.9)	12.4 (9.18-15.1)
10-min	2.20 (1.84-2.72)	2.88 (2.41-3.56)	3.88 (3.20-4.76)	4.62 (3.78-5.65)	5.59 (4.51-6.82)	6.31 (5.04-7.66)	7.04 (5.53-8.52)	7.76 (6.01-9.38)	8.70 (6.58-10.5)	9.44 (6.99-11.5)
15-min	1.82 (1.52-2.25)	2.38 (1.99-2.94)	3.20 (2.64-3.94)	3.82 (3.12-4.67)	4.62 (3.73-5.64)	5.22 (4.17-6.33)	5.82 (4.57-7.04)	6.41 (4.96-7.75)	7.19 (5.44-8.72)	7.80 (5.78-9.50)
30-min	1.23 (1.02-1.51)	1.60 (1.34-1.98)	2.16 (1.78-2.65)	2.57 (2.10-3.15)	3.11 (2.51-3.79)	3.51 (2.81-4.26)	3.92 (3.08-4.74)	4.32 (3.34-5.22)	4.84 (3.66-5.87)	5.26 (3.89-6.40)
60-min	0.759 (0.632-0.936)	0.992 (0.828-1.23)	1.34 (1.10-1.64)	1.59 (1.30-1.95)	1.93 (1.55-2.35)	2.17 (1.74-2.64)	2.42 (1.90-2.93)	2.67 (2.07-3.23)	3.00 (2.27-3.63)	3.25 (2.41-3.96)
2-hr	0.436 (0.366-0.525)	0.564 (0.474-0.682)	0.748 (0.624-0.901)	0.886 (0.733-1.07)	1.07 (0.878-1.29)	1.21 (0.981-1.45)	1.36 (1.08-1.62)	1.50 (1.17-1.78)	1.69 (1.29-2.01)	1.83 (1.38-2.19)
3-hr	0.311 (0.261-0.381)	0.398 (0.335-0.490)	0.518 (0.434-0.636)	0.614 (0.509-0.750)	0.746 (0.608-0.905)	0.850 (0.684-1.03)	0.956 (0.758-1.16)	1.07 (0.832-1.29)	1.22 (0.922-1.47)	1.34 (0.990-1.61)
6-hr	0.189 (0.162-0.224)	0.238 (0.205-0.283)	0.302 (0.258-0.358)	0.353 (0.299-0.416)	0.422 (0.353-0.496)	0.476 (0.393-0.558)	0.532 (0.433-0.623)	0.589 (0.470-0.689)	0.662 (0.516-0.774)	0.720 (0.549-0.842)
12-hr	0.113 (0.098-0.132)	0.142 (0.123-0.166)	0.178 (0.154-0.208)	0.207 (0.178-0.241)	0.247 (0.209-0.286)	0.277 (0.232-0.320)	0.308 (0.254-0.356)	0.339 (0.276-0.392)	0.379 (0.302-0.441)	0.410 (0.321-0.479)
24-hr	0.069 (0.061-0.080)	0.088 (0.078-0.101)	0.115 (0.101-0.132)	0.136 (0.120-0.156)	0.167 (0.145-0.191)	0.191 (0.164-0.219)	0.217 (0.184-0.250)	0.244 (0.204-0.283)	0.283 (0.231-0.331)	0.314 (0.253-0.371)
2-day	0.040 (0.035-0.046)	0.051 (0.045-0.059)	0.068 (0.059-0.078)	0.081 (0.071-0.093)	0.100 (0.086-0.115)	0.115 (0.098-0.132)	0.132 (0.111-0.152)	0.149 (0.124-0.173)	0.174 (0.142-0.204)	0.194 (0.155-0.229)
3-day	0.029 (0.025-0.033)	0.037 (0.033-0.042)	0.049 (0.043-0.056)	0.059 (0.052-0.068)	0.074 (0.064-0.084)	0.086 (0.073-0.098)	0.099 (0.083-0.113)	0.112 (0.094-0.130)	0.132 (0.108-0.154)	0.148 (0.119-0.175)
4-day	0.023 (0.021-0.027)	0.030 (0.026-0.034)	0.040 (0.035-0.046)	0.049 (0.042-0.055)	0.061 (0.053-0.069)	0.071 (0.061-0.081)	0.082 (0.069-0.094)	0.094 (0.078-0.109)	0.111 (0.091-0.130)	0.125 (0.101-0.148)
7-day	0.015 (0.013-0.018)	0.020 (0.017-0.023)	0.026 (0.023-0.030)	0.032 (0.028-0.037)	0.040 (0.035-0.046)	0.047 (0.040-0.054)	0.055 (0.046-0.063)	0.063 (0.052-0.074)	0.075 (0.061-0.088)	0.085 (0.067-0.101)
10-day	0.012 (0.010-0.013)	0.015 (0.013-0.017)	0.020 (0.018-0.023)	0.024 (0.021-0.028)	0.031 (0.026-0.035)	0.036 (0.030-0.041)	0.041 (0.035-0.047)	0.047 (0.039-0.055)	0.056 (0.045-0.065)	0.063 (0.050-0.075)
20-day	0.007 (0.007-0.008)	0.010 (0.008-0.011)	0.013 (0.011-0.015)	0.015 (0.013-0.017)	0.019 (0.016-0.021)	0.022 (0.019-0.025)	0.024 (0.021-0.028)	0.027 (0.023-0.032)	0.032 (0.026-0.037)	0.035 (0.029-0.041)
30-day	0.006 (0.005-0.007)	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.012 (0.011-0.014)	0.015 (0.013-0.017)	0.017 (0.015-0.019)	0.019 (0.016-0.022)	0.021 (0.018-0.025)	0.025 (0.021-0.029)	0.027 (0.022-0.032)
45-day	0.005 (0.004-0.005)	0.006 (0.005-0.007)	0.008 (0.007-0.009)	0.010 (0.008-0.011)	0.012 (0.010-0.013)	0.013 (0.012-0.015)	0.015 (0.013-0.017)	0.017 (0.014-0.020)	0.020 (0.016-0.023)	0.022 (0.018-0.025)
60-day	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.014)	0.014 (0.012-0.016)	0.016 (0.013-0.019)	0.017 (0.014-0.020)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

PDS-based intensity-duration-frequency (IDF) curves
 Latitude: 33.7100°, Longitude: -111.8000°



[Back to Top](#)

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APPENDIX II

Calculations

8280 E. Gelding Dr., Suite 101
Scottsdale, AZ 85260

Pond Routing Calculations

REQUIRED STORAGE: 100-yr Event BASIN 2

Tc (min.)	I100	A (ac)	C	Q(in) (cfs)	Q (out) (cfs)	Qi-QoxTcx60 (cf)
5	9.25	4.52	0.79	33.03	0.35	9803.97
10	7.04	4.52	0.79	25.14	0.35	14873.06
15	5.82	4.52	0.79	20.78	0.35	18388.85
30	3.92	4.52	0.79	14.00	0.35	24565.56
60	2.42	4.52	0.79	8.64	0.35	29848.81
120	1.36	4.52	0.79	4.86	0.35	32445.27
180	0.956	4.52	0.79	3.41	0.35	33087.80
360	0.532	4.52	0.79	1.90	0.35	33472.78
720	0.308	4.52	0.79	1.10	0.35	32391.64
1440	0.217	4.52	0.79	0.77	0.35	36708.22

EXISTING CONDITION

Tc (min.)	I100	A (ac)	C	Q (cfs)
5	9.25	4.52	0.45	18.81
10	7.04	4.52	0.45	14.32
15	5.82	4.52	0.45	11.84
30	3.92	4.52	0.45	7.97
60	2.42	4.52	0.45	4.92
120	1.36	4.52	0.45	2.77
180	0.956	4.52	0.45	1.94
360	0.532	4.52	0.45	1.08
720	0.308	4.52	0.45	0.63
1440	0.217	4.52	0.45	0.44

Existing Outlet Discharge Calculation

	Inflow	Area(ac)	Cw	Q (CFS)	Total Outflow (CFS)
	Inlet 1-1	0.00	0.00	58	
	Inlet 1-2	0.00	0.00	112	
To CP 1-OUT	EX-7	1.54	0.45	6	176
To CP 2-OUT	EX-6	0.72	0.45	3	3
To CP 3-OUT	EX-1	1.33	0.45	6	6
	Inlet 2-1	0.00	0.00	322	
	Inlet 2-2	0.00	0.00	3	
	Inlet 2-3	0.00	0.00	24	
	Inlet 2-4	0.00	0.00	21	
To CP 4-OUT	EX-2	16.30	0.45	43	413
	Inlet 3-1	0.00	0.00	14	
	Inlet 3-2	0.00	0.00	10	
To CP 5-OUT	EX-3	14.84	0.45	47	71
To CP 6-OUT	EX-8	0.48	0.45	2	2
To CP 7-OUT	EX-9	0.96	0.45	4	4
	EX-4	2.82	0.45	9	
To CP 8-OUT	Inlet 4-1	0.00	0.00	173	182
To CP 9-OUT	EX-5	0.52	0.45	2	2
TOTAL					858.74

Proposed Outlet Discharge Calculation

	DA	Area(ac)	Cw	Q (CFS)	Inflow (CFS)	Total Outflow (CFS)
To CP-1-OUT	DA1	0.95	0.45	4	170	174
To CP-4-OUT	DA5	2.83	0.45	12	349	366
	DA5A	1.18	0.45	5		
To CP 5-OUT	DA11A	1.19	0.45	5	45	55
	DA10	1.33	0.45	6		
To CP 8-OUT	DA14	0.90	0.45	4	173	177
	TOTAL	7.43				

PROPOSED RETENTION VOLUME CALCULATIONS

BASIN 1					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2657.00	10,688	1.00	11,841.00	0.00	
2658.00	12,994	1.00	14,203.50	11,841.00	
2659.00	15,413	1.00	16,676.00	26,044.50	
2660.00	17,939	1.00	19,138.50	42,720.50	

BASIN 2					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2643.00	9,604	1.00	10,667.00	0.00	
2644.00	11,730	1.00	12,850.00	10,667.00	
2645.00	13,970	1.00	15,129.50	23,517.00	
2646.00	16,289	1.00	17,617.50	38,546.50	

BASIN 3					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2661.00	36	1.00	430.50	0.00	
2662.00	825	1.00	911.50	430.50	
2663.00	1,814	1.00	2,004.00	1,750.00	
2664.00	3,014	1.00	3,315.50	4,164.00	

BASIN 4					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2665.00	1,024	1.00	1,126.50	0.00	
2666.00	1,779	1.00	1,971.50	1,126.50	
2667.00	2,662	1.00	2,927.50	3,622.00	
2668.00	3,674	1.00	4,083.50	6,790.00	

PROVIDED RETENTION VOLUME SUMMARY		REQUIRED RETENTION VOLUME SUMMARY	
BASIN ID	VOLUME PROVIDED (C.F.)	BASIN ID	VOLUME PROVIDED (C.F.)
1	42,721	1	42,167
2	38,647	2	36,708
3	4,164	3	3,607
4	6,790	4	4,819
5	4,963	5	1,618
TOTAL	97,284	TOTAL	88,919

BASIN 5					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2665.00	709	1.00	779.50	0.00	
2666.00	1,273	1.00	1,402.50	779.50	
2667.00	1,966	1.00	2,161.50	2,610.50	
2668.00	2,738	1.00	3,011.50	4,962.50	

Required Storage Volume Calculations

Required Storage Volume Calculations						
						$V_r = 1 * (P/12) * C_w * A$ P=100-yr, 2-hr=2.65 in.
Drainage	Disturbed	C_w	intensity	Q-100	Volume Req.	Volume Req.
Area ID	(acres)	(-)	(in/hr)	(cfs)	(acre-ft)	(CF)
RETENTION BASIN 1						
DA9	0.71	0.53	9.25	3.51	0.086	3,735.13
DA11	2.88	0.54	9.25	14.45	0.353	15,365.40
DA11B	0.97	0.58	9.25	5.22	0.127	5,549.02
DA12	1.70	0.95	9.25	14.94	0.365	15,887.24
DA13	0.35	0.47	9.25	1.53	0.037	1,630.39
Basin 1 Totals:	5.90	0.73		36.14	0.882	42,167.18
RETENTION BASIN 2						
DA3	1.12	0.95	9.25	9.84	0.240	10,466.89
DA6	0.52	0.50	9.25	2.40	0.059	2,549.37
DA7	1.58	0.54	9.25	7.90	0.193	8,397.63
DA8	1.90	0.60	9.25	10.46	0.255	11,125.29
DA8A	1.04	0.52	9.25	4.99	0.122	5,304.43
Basin 2 Totals:	4.52	0.79		23.35	0.570	37,843.61
Retention Basin 3						
DA4	0.71	0.52	9.25	3.39	0.083	3,607.02
Basin 3 Totals:	0.71	0.52		3.39	0.083	3,607.02
Retention Basin 4						
DA2	0.93	0.53	9.25	4.53	0.111	4,818.62
Basin 4 Totals:	0.93	0.53		4.53	0.111	4,818.62
Retention Basin 5						
DA15	0.33	0.50	9.25	1.52	0.037	1,618.09
Basin 6 Totals:	0.33	0.50		1.52	0.037	1,618.09
Totals	10.42			59.48	1.45	90,054.52

WEIGHTED RUNOFF COEFFICIENTS

DA	Area(ac)	Desert Landscape Area (ac)	Conc./Asphalt / Roof Area (ac)	Roadway Area (ac)	Cw
1	0.95	0.95	0.00	0.00	0.45
2	1.94	1.01	0.93	0.00	0.53
3	1.12	0.00	0.00	1.12	0.95
4	1.71	1.00	0.71	0.00	0.52
5	2.83	2.83	0.00	0.00	0.45
5A	1.18	1.18	0.00	0.00	0.45
6	1.72	1.20	0.52	0.00	0.50
7	2.8	1.22	1.58	0.00	0.54
8	3.10	1.20	1.47	0.43	0.60
8A	2.43	1.39	1.04	0.00	0.52
9	1.34	0.63	0.71	0.00	0.53
10	1.33	1.33	0.00	0.00	0.45
11	4.99	2.11	2.88	0.00	0.54
11A	0.57	0.57	0.00	0.00	0.45
11B	1.18	0.21	0.97	0.00	0.58
12	1.70	0.00	0.00	1.70	0.95
13	2.38	2.03	0.35	0.00	0.47
14	0.90	0.90	0.00	0.00	0.45
15	1.09	0.76	0.33	0.00	0.50
SUM:	35.26	20.52	11.49	3.25	0.55
Cvalue:		0.45	0.61	0.95	

EXISTING DRAINAGE AREAS TIME OF CONCENTRATION

EX1

$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$		0.089 Hours	5.31 Min.
L=	0.07 MILES		
K _b =	0.1469	$m \log_{10} A + b =$	
S=	220.00 FT/MILE		
i=	9.250 IN/HR	From NOAA	
m=	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	1.33 ACRES		
Q=CiA	5.5361 CFS		
C=	0.45		
i=	9.250 IN/HR		
A=	1.33 ACRES		

EX2

$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$		0.252 Hours	15.11 Min.
L=	0.32 MILES		
K _b =	0.1197	$m \log_{10} A + b =$	
S=	112.50 FT/MILE		
i=	5.820 IN/HR	From NOAA	
m=	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	16.30 ACRES		
Q=CiA	42.6897 CFS		
C=	0.45		
i=	5.820 IN/HR		
A=	16.30 ACRES		

EX3

$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$		0.196 Hours	11.78 Min.
L=	0.28 MILES		
K _b =	0.1207	$m \log_{10} A + b =$	
S=	165.43 FT/MILE		
i=	7.040 IN/HR	From NOAA	
m=	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	14.84 ACRES		
Q=CiA	47.0131 CFS		
C=	0.45		
i=	7.040 IN/HR		

A=	14.84 ACRES
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EX4

$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.134 Hours	8.06 Min.
L=	0.11 MILES	
$K_b =$	0.1387	$m \log_{10}A + b =$
S=	154.55 FT/MILE	
i=	7.040 IN/HR	From NOAA
m=	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	2.82 ACRES	
Q=CiA	8.9338 CFS	
C=	0.45	
i=	7.040 IN/HR	
A=	2.82 ACRES	

EX5

$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.075 Hours	4.51 Min.
L=	0.04 MILES	
$K_b =$	0.1571	$m \log_{10}A + b =$
S=	154.55 FT/MILE	
i=	9.250 IN/HR	From NOAA
m=	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.52 ACRES	
Q=CiA	2.1645 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	0.52 ACRES	

EX6

$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.076 Hours	4.55 Min.
L=	0.05 MILES	
$K_b =$	0.1536	$m \log_{10}A + b =$
S=	274.05 FT/MILE	
i=	9.250 IN/HR	From NOAA
m=	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.72 ACRES	
Q=CiA	2.9970 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	0.72 ACRES	

EX7

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.120 Hours	7.19 Min.
L=	0.08 MILES	
$K_b=$	0.1453	$m \log_{10}A+b=$
S=	105.60 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.54 ACRES	
Q=CiA	6.4103 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	1.54 ACRES	

EX8

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.068 Hours	4.09 Min.
L=	0.05 MILES	
$K_b=$	0.1580	$m \log_{10}A+b=$
S=	312.80 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.48 ACRES	
Q=CiA	1.9980 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	0.48 ACRES	

EX9

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.090 Hours	5.42 Min.
L=	0.07 MILES	
$K_b=$	0.1504	$m \log_{10}A+b=$
S=	232.86 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.96 ACRES	

Q=CiA	3.9960 CFS
C=	0.45
i=	9.250 IN/HR
A=	0.96 ACRES

PROPOSED DRAINAGE AREAS TIME OF CONCENTRATION

DA1

$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$	0.103 Hours	6.16 Min.
L=	0.07 MILES	
$K_b =$	0.1506	$m \log_{10} A + b =$
S=	135.77 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.95 ACRES	
Q=CiA	3.95 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	0.95 ACRES	

DA2

$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$	0.130 Hours	7.81 Min.
L=	0.07 MILES	
$K_b =$	0.1428	$m \log_{10} A + b =$
S=	68.22 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.94 ACRES	
Q=CiA	9.51 CFS	
C=	0.53	
i=	9.250 IN/HR	
A=	1.94 ACRES	

DA3

$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$	0.137 Hours	8.23 Min.
L=	0.09 MILES	
$K_b =$	0.1488	$m \log_{10} A + b =$
S=	87.63 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.12 ACRES	
Q=CiA	9.84 CFS	
C=	0.95	
i=	9.250 IN/HR	
A=	1.12 ACRES	

DA4

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.106 Hours	6.36 Min.
L=	0.06 MILES	
$K_b=$	0.1442	$m \log_{10}A+b=$
S=	99.00 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.71 ACRES	
Q=CiA	8.23 CFS	
C=	0.52	
i=	9.250 IN/HR	
A=	1.71 ACRES	

DA5

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.183 Hours	10.99 Min.
L=	0.17 MILES	
$K_b=$	0.1387	$m \log_{10}A+b=$
S=	117.33 FT/MILE	
i=	7.040 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	2.83 ACRES	
Q=CiA	8.97 CFS	
C=	0.45	
i=	7.040 IN/HR	
A=	2.83 ACRES	

DA5A

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.133 Hours	7.95 Min.
L=	0.12 MILES	
$K_b=$	0.1482	$m \log_{10}A+b=$
S=	154.55 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.18 ACRES	
Q=CiA	4.91 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	1.18 ACRES	

DA6

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.094 Hours	5.66 Min.
L=	0.06 MILES	
$K_b =$	0.1441	$m \log_{10}A+b =$
S=	156.68 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.72 ACRES	
Q=CiA	7.96 CFS	
C=	0.5	
i=	9.250 IN/HR	
A=	1.72 ACRES	

DA7

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.141 Hours	8.45 Min.
L=	0.14 MILES	
$K_b =$	0.1388	$m \log_{10}A+b =$
S=	142.90 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	2.80 ACRES	
Q=CiA	13.99 CFS	
C=	0.54	
i=	9.250 IN/HR	
A=	2.80 ACRES	

DA8

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.219 Hours	13.13 Min.
L=	0.12 MILES	
$K_b =$	0.1377	$m \log_{10}A+b =$
S=	34.74 FT/MILE	
i=	7.040 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	3.10 ACRES	
Q=CiA	13.09 CFS	
C=	0.60	
i=	7.040 IN/HR	
A=	3.10 ACRES	

DA8A

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.113 Hours	6.76 Min.
L=	0.06 MILES	
$K_b =$	0.1404	$m \log_{10}A+b =$
S=	70.17 FT/MILE	

i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	2.43 ACRES	
Q=CiA	11.69 CFS	
C=	0.52	
i=	9.250 IN/HR	
A=	2.43 ACRES	

DA9

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.070 Hours	4.22 Min.
L=	0.06 MILES	
$K_b=$	0.1468	$m \log_{10}A+b=$
S=	369.94 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.34 ACRES	
Q=CiA	6.57 CFS	
C=	0.53	
i=	9.250 IN/HR	
A=	1.34 ACRES	

DA10

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.318 Hours	19.07 Min.
L=	0.16 MILES	
$K_b=$	0.1469	$m \log_{10}A+b=$
S=	23.84 FT/MILE	
i=	5.820 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.33 ACRES	
Q=CiA	3.48 CFS	
C=	0.45	
i=	5.820 IN/HR	
A=	1.33 ACRES	

DA11

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.179 Hours	10.75 Min.
L=	0.19 MILES	
$K_b=$	0.1325	$m \log_{10}A+b=$
S=	134.42 FT/MILE	
i=	7.040 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)

A=	4.99 ACRES	
Q=CiA	5.67 CFS	
C=	0.54	
i=	7.040 IN/HR	
A=	4.99 ACRES	

DA11A

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.334 Hours	20.03 Min.
L=	0.33 MILES	
K _b =	0.1561	$m \log_{10}A+b=$
S=	75.76 FT/MILE	
i=	5.820 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.57 ACRES	
Q=CiA	1.49 CFS	
C=	0.45	
i=	5.820 IN/HR	
A=	0.57 ACRES	

DA11B

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.339 Hours	20.35 Min.
L=	0.25 MILES	
K _b =	0.1436	$m \log_{10}A+b=$
S=	40.00 FT/MILE	
i=	5.820 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.80 ACRES	
Q=CiA	6.08 CFS	
C=	0.58	
i=	5.820 IN/HR	
A=	1.80 ACRES	

DA12

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.207 Hours	12.44 Min.
L=	0.17 MILES	
K _b =	0.1442	$m \log_{10}A+b=$
S=	86.46 FT/MILE	
i=	7.040 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.70 ACRES	
Q=CiA	11.37 CFS	
C=	0.95	

i=	7.040 IN/HR
A=	1.70 ACRES

DA13

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.178 Hours	10.66 Min.
L=	0.05 MILES	
$K_b=$	0.1406	$m \log_{10}A+b=$
S=	19.34 FT/MILE	
i=	7.040 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	2.38 ACRES	
Q=CiA	7.87 CFS	
C=	0.47	
i=	7.040 IN/HR	
A=	2.38 ACRES	

DA14

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.132 Hours	7.95 Min.
L=	0.10 MILES	
$K_b=$	0.1511	$m \log_{10}A+b=$
S=	112.56 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	0.90 ACRES	
Q=CiA	3.75 CFS	
C=	0.45	
i=	9.250 IN/HR	
A=	0.90 ACRES	

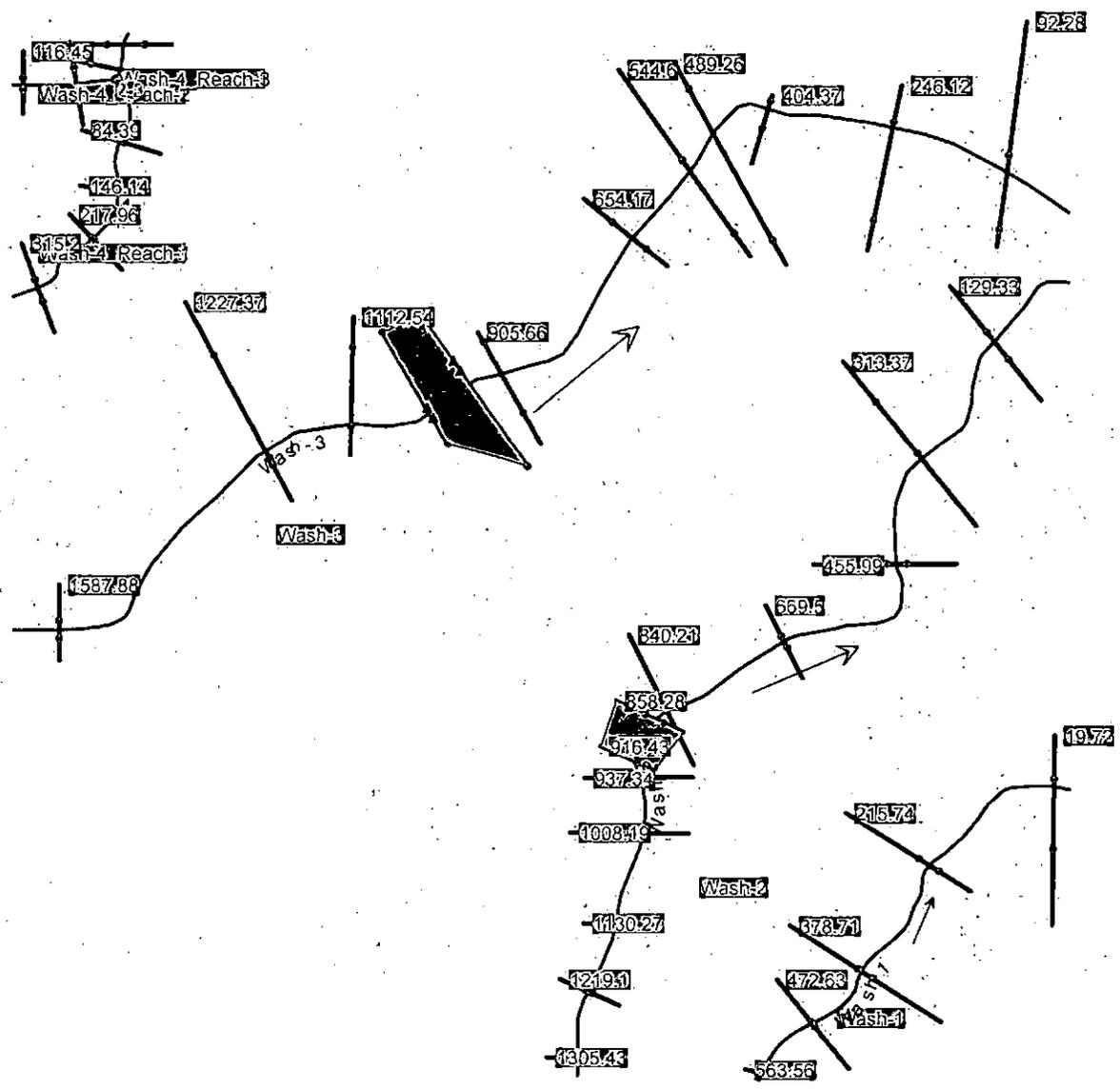
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$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38} =$	0.067 Hours	4.03 Min.
L=	0.04 MILES	
$K_b=$	0.1491	$m \log_{10}A+b=$
S=	243.32 FT/MILE	
i=	9.250 IN/HR	From NOAA
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)
A=	1.09 ACRES	
Q=CiA	5.04 CFS	
C=	0.50	
i=	9.250 IN/HR	
A=	1.09 ACRES	



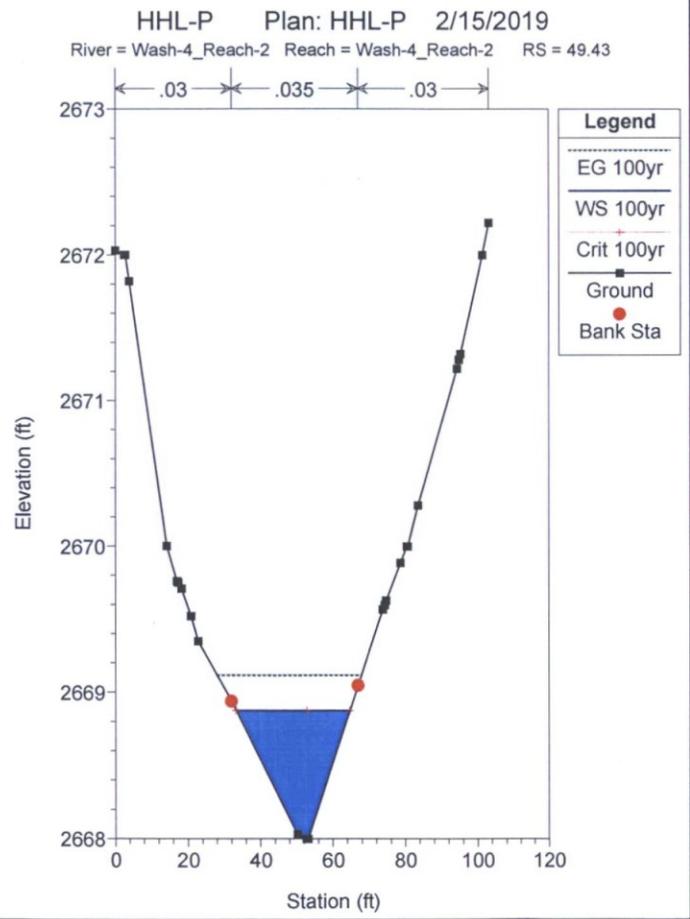
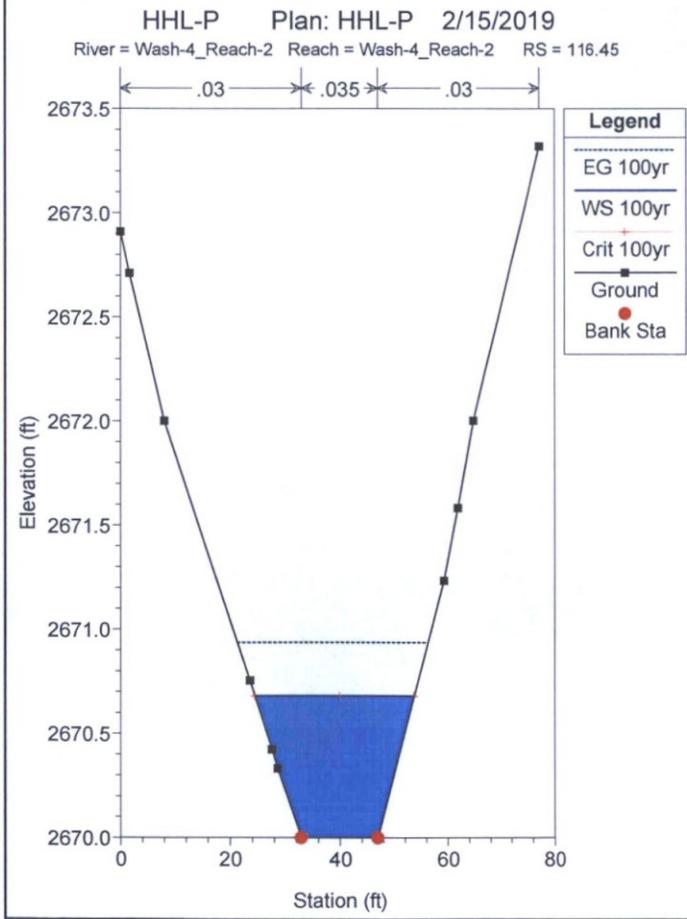
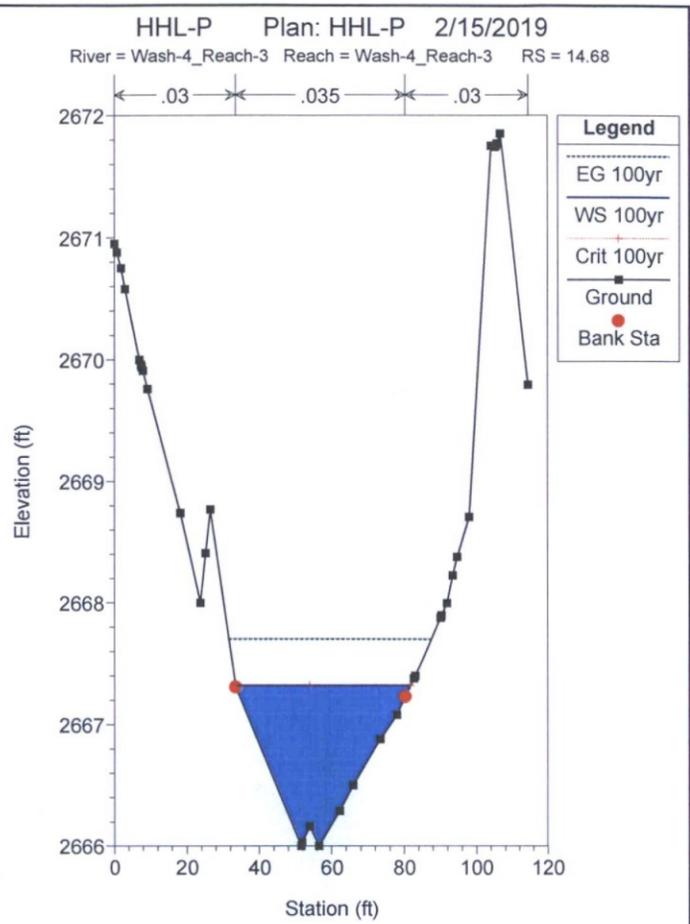
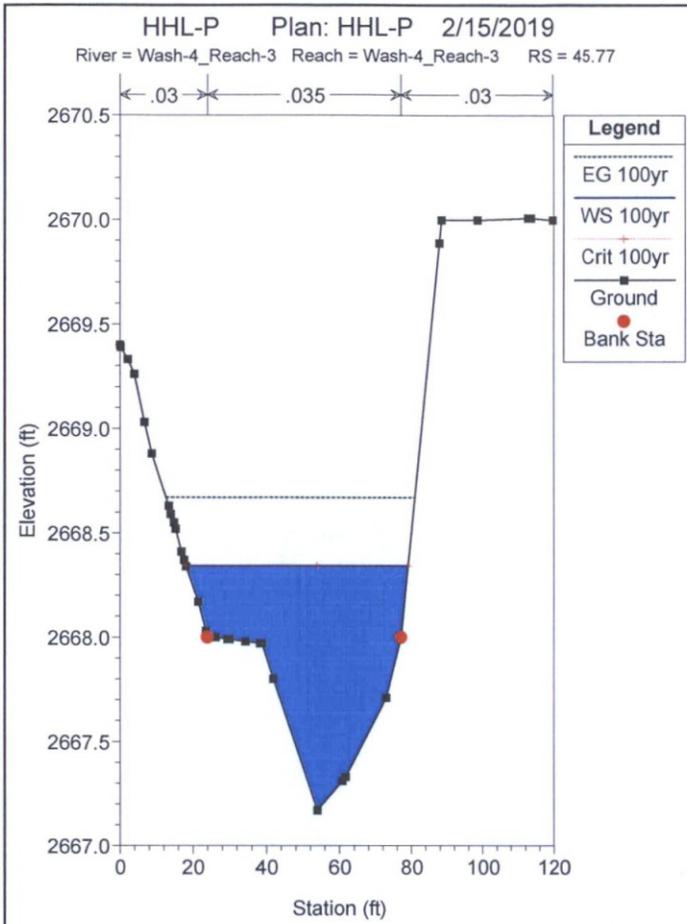
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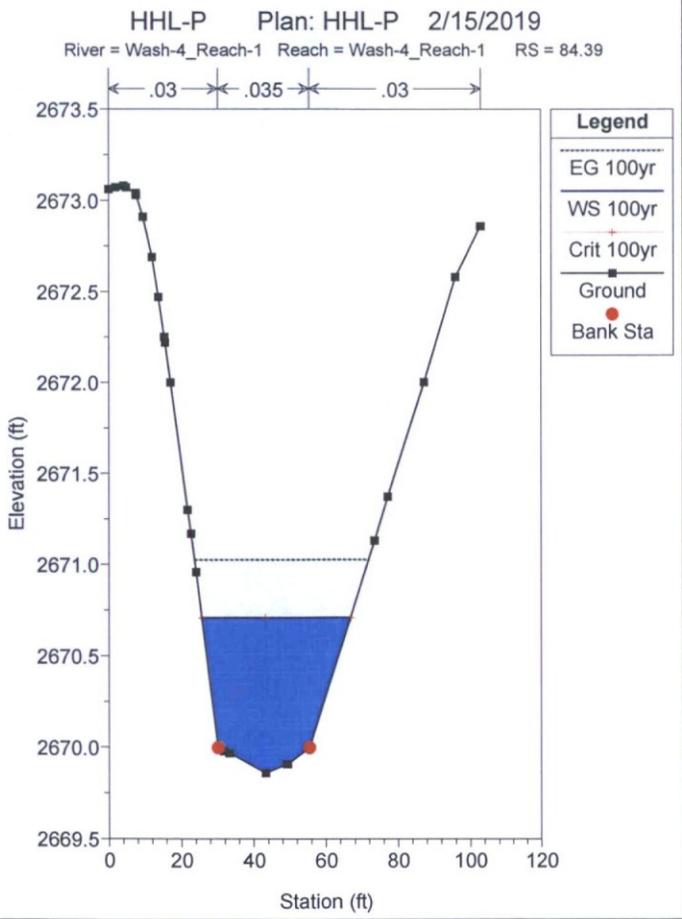
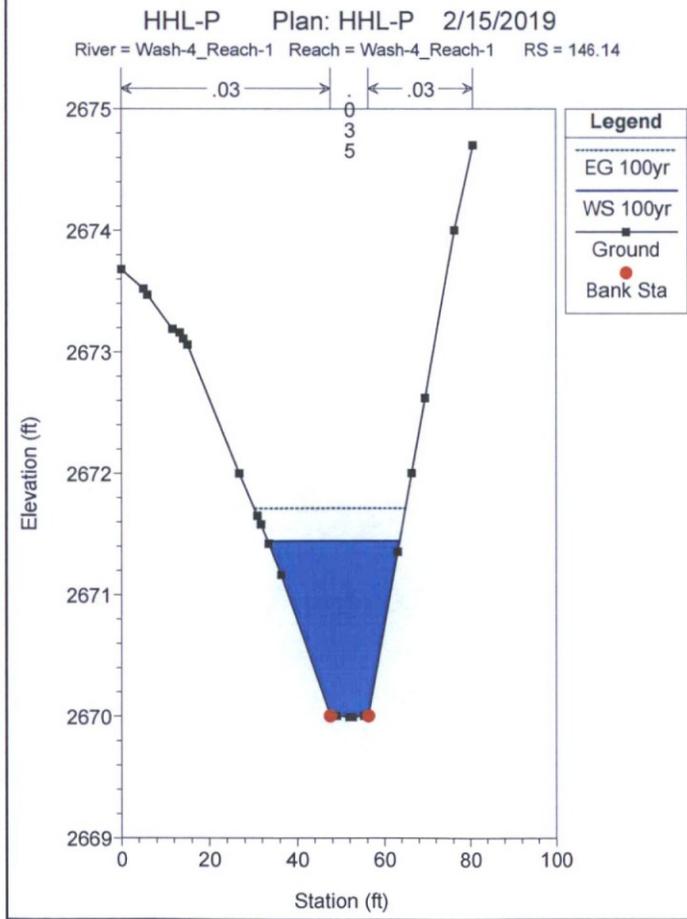
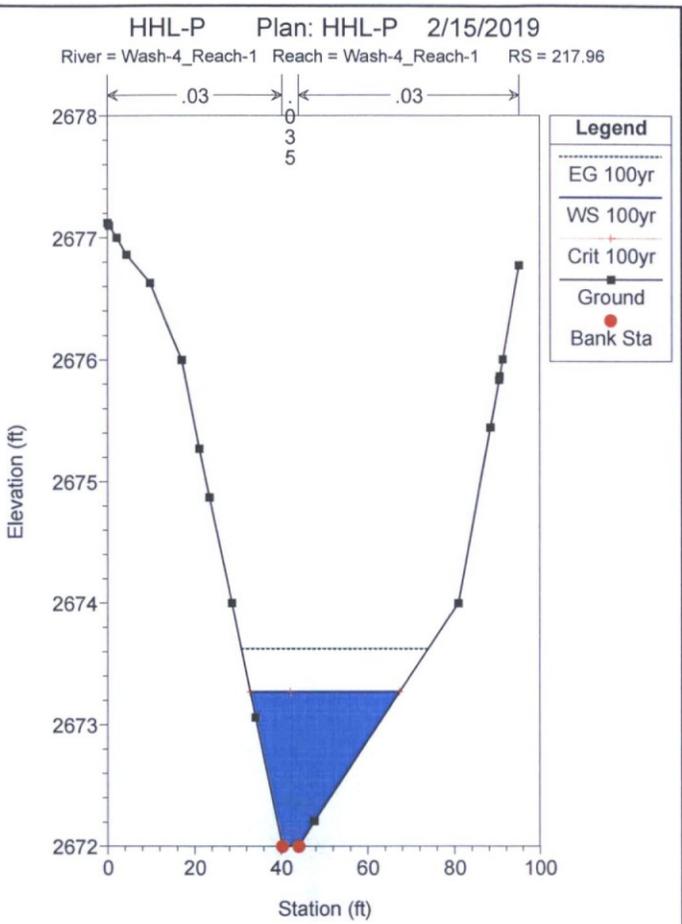
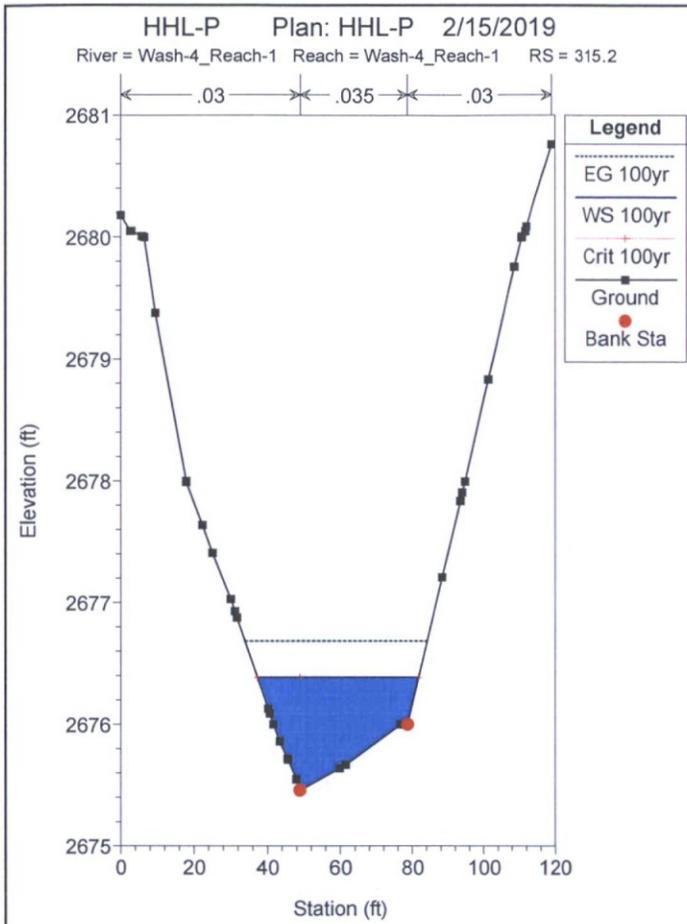
Proposed HEC-RAS Model

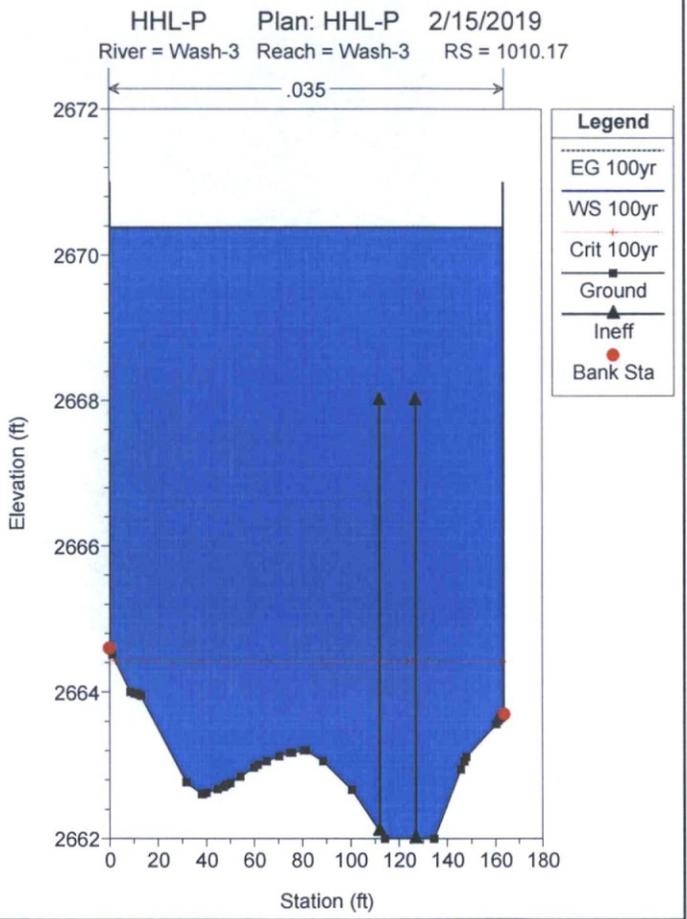
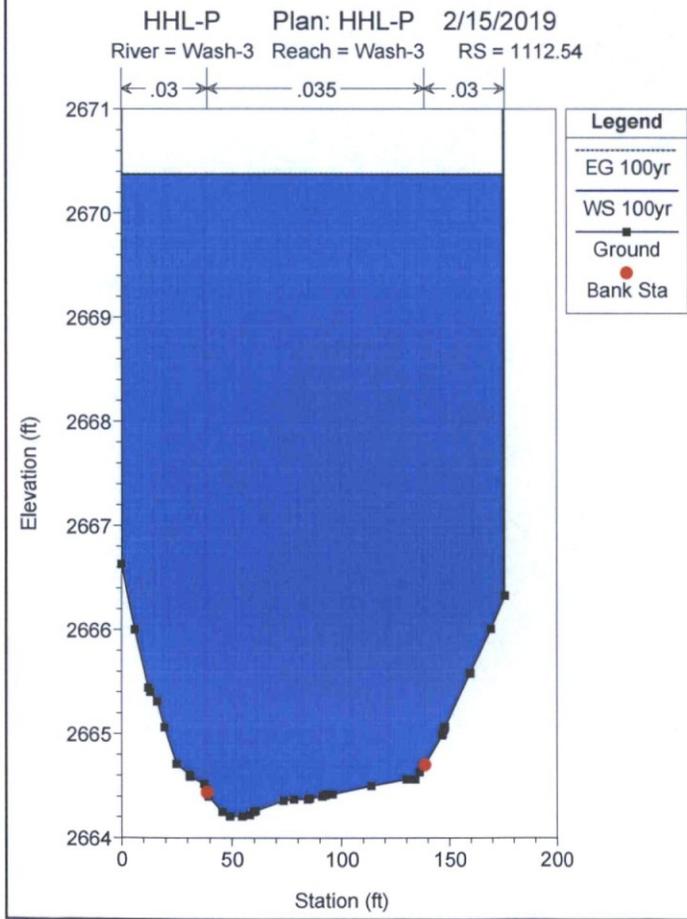
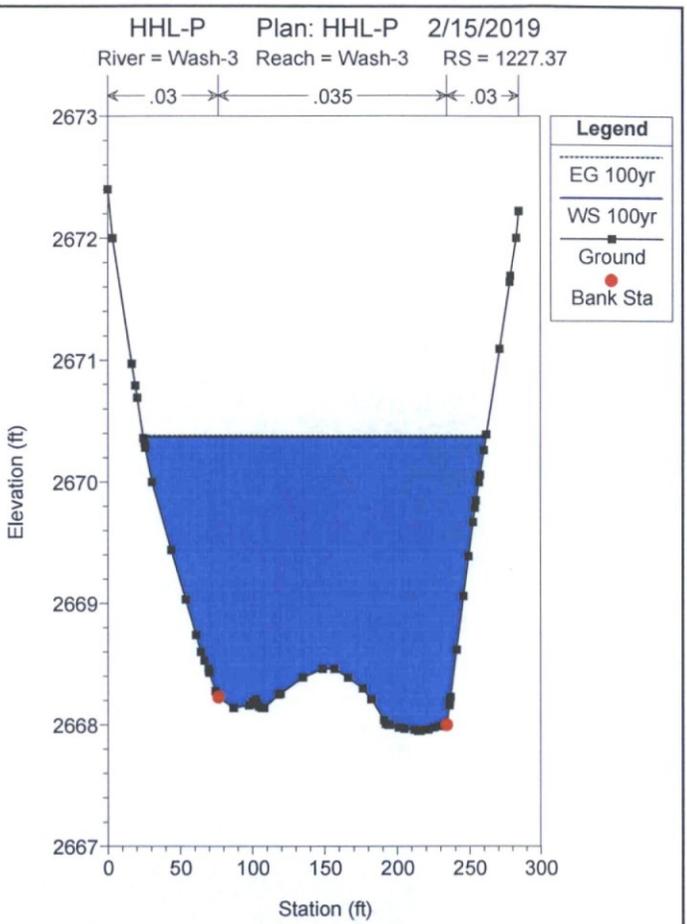
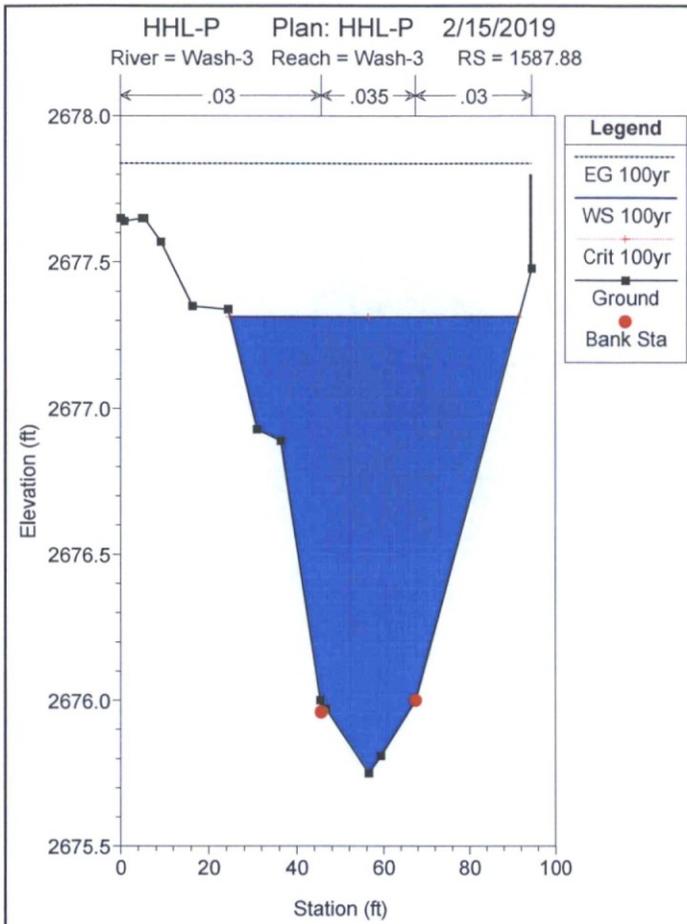


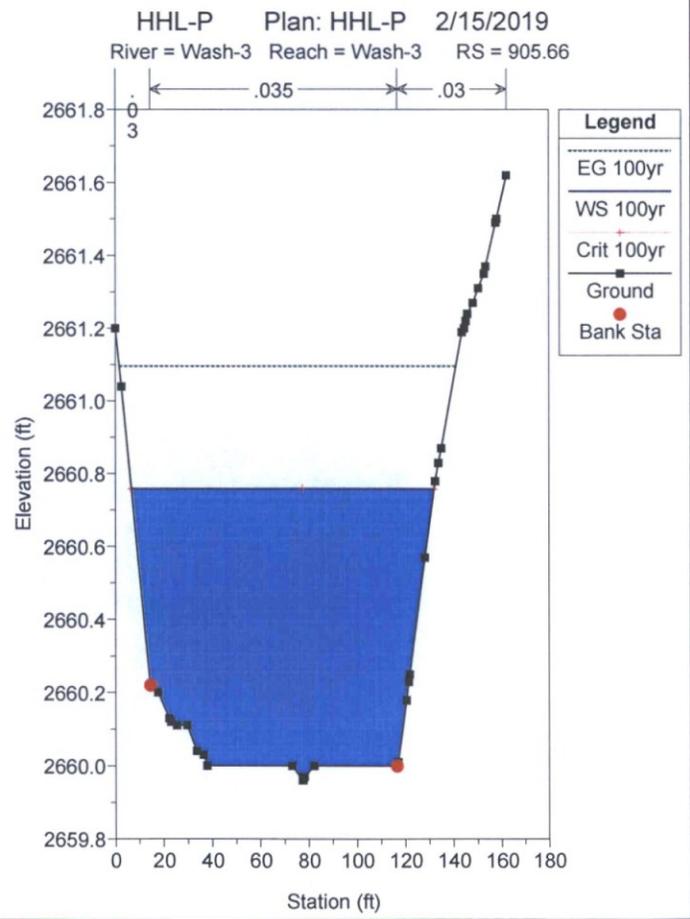
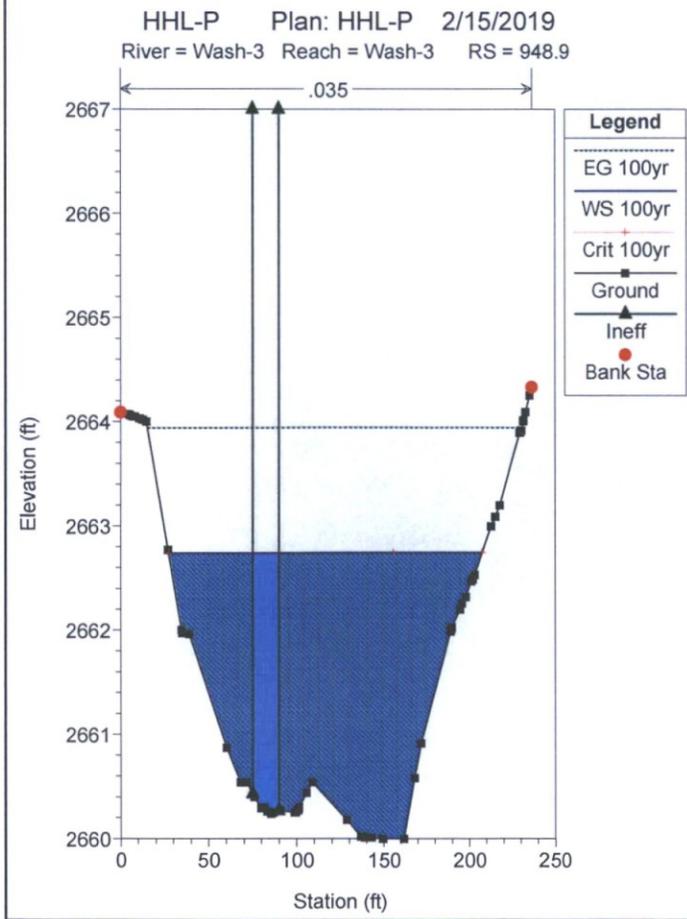
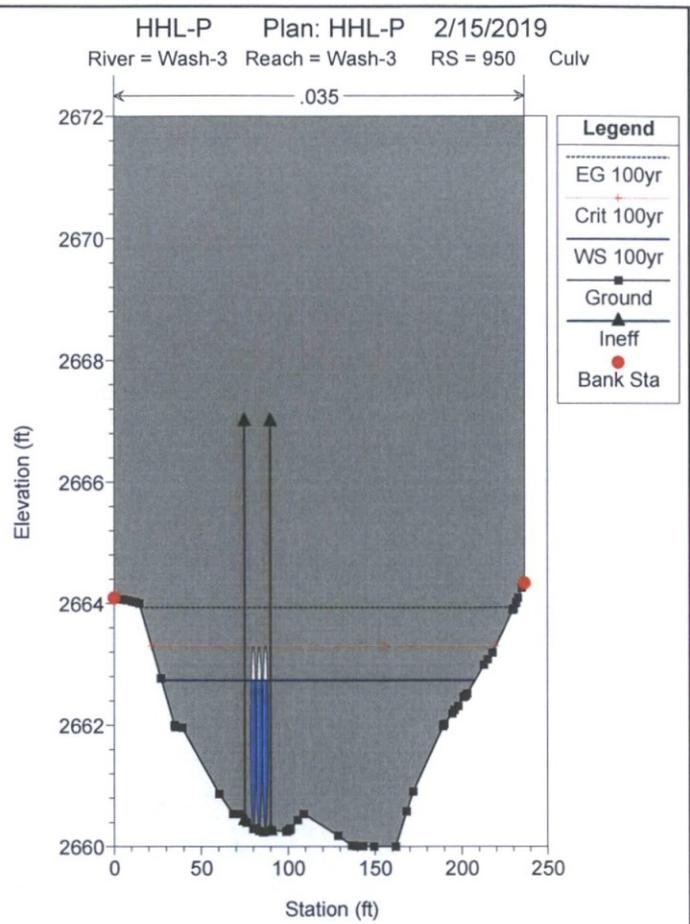
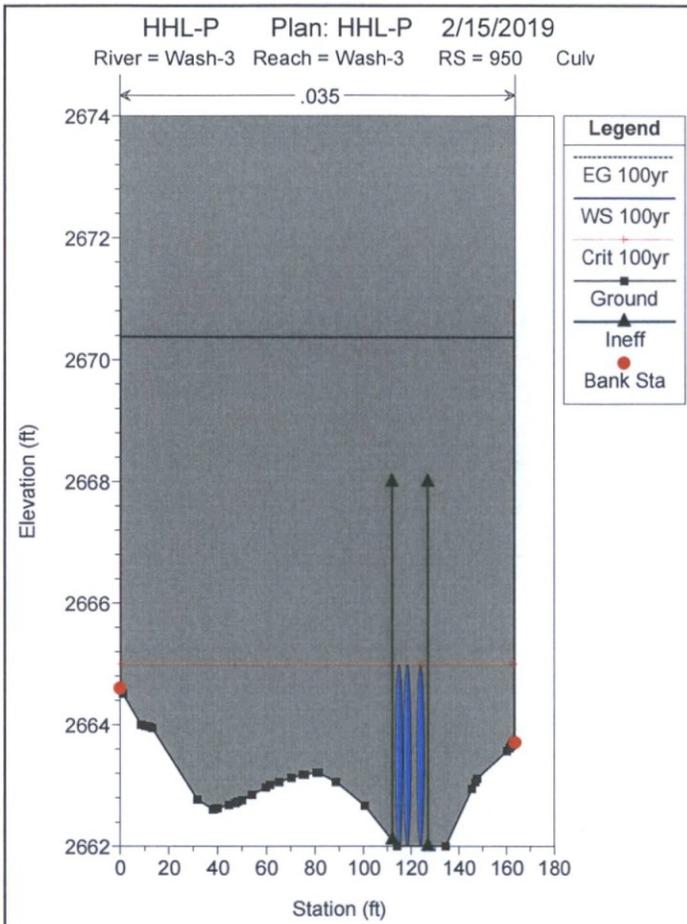
HEC-RAS Plan: P Profile: 100yr

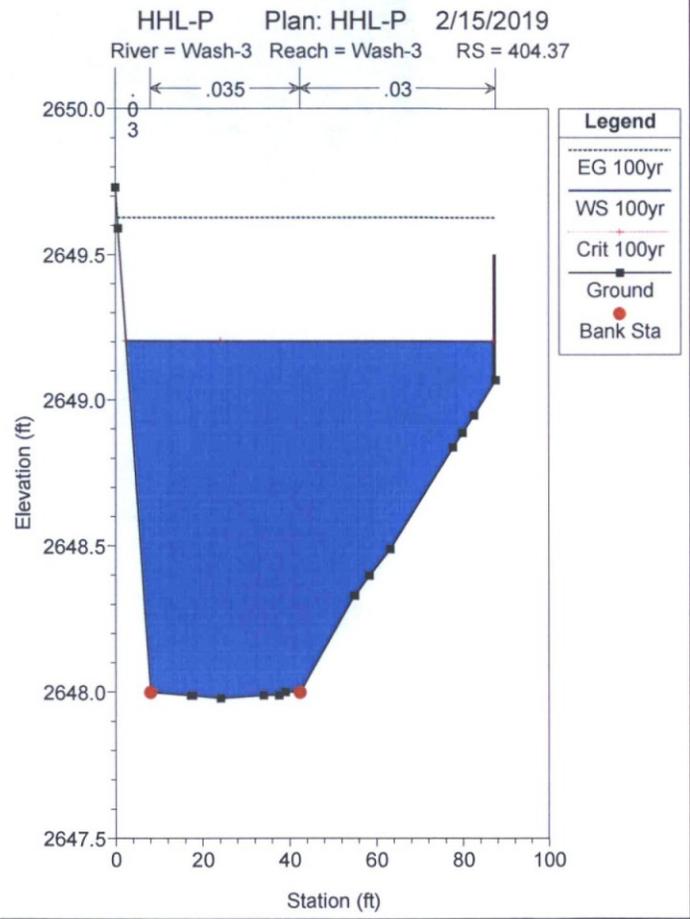
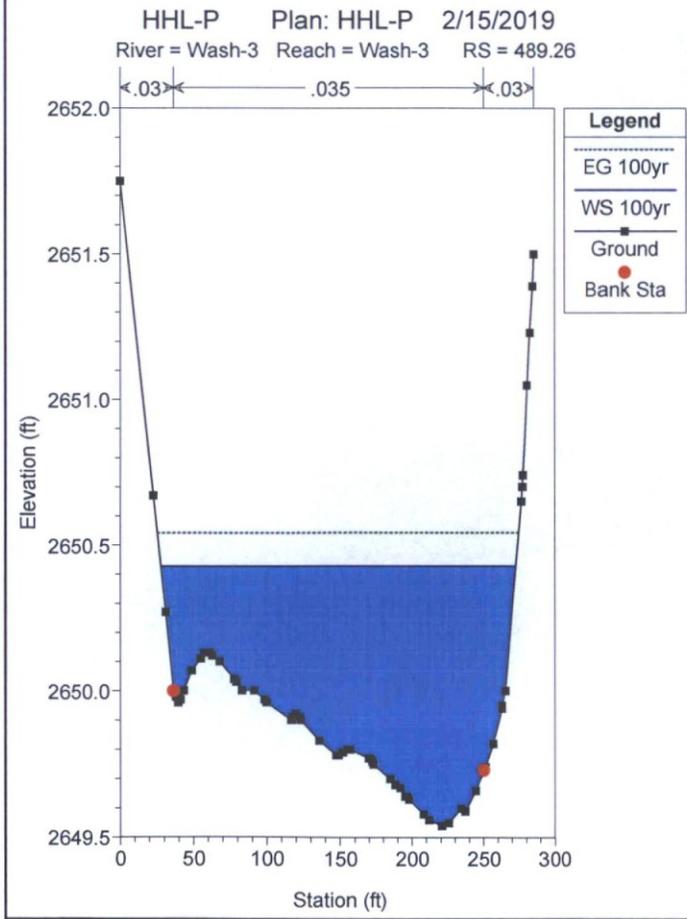
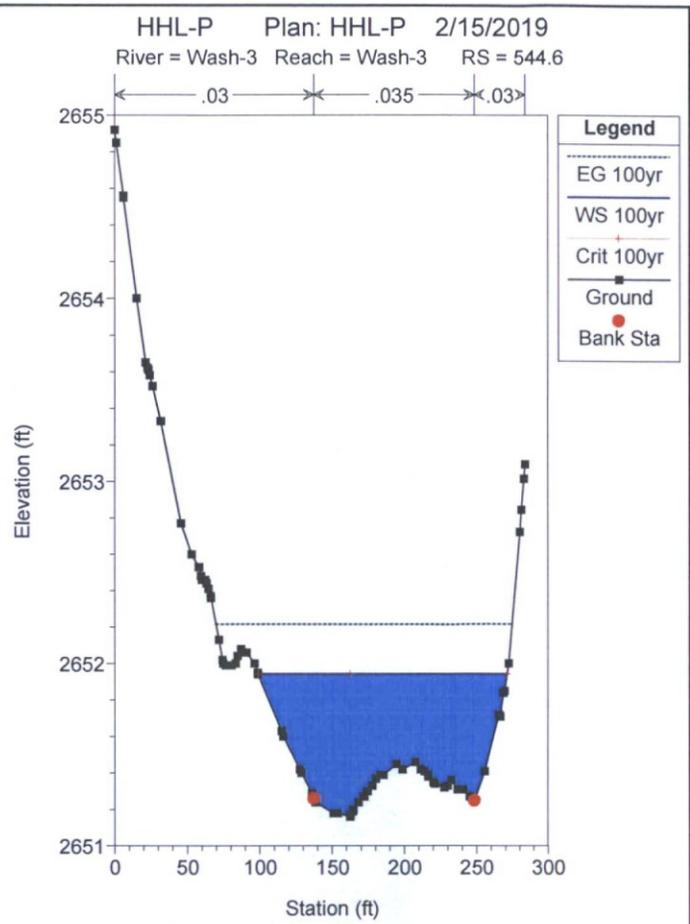
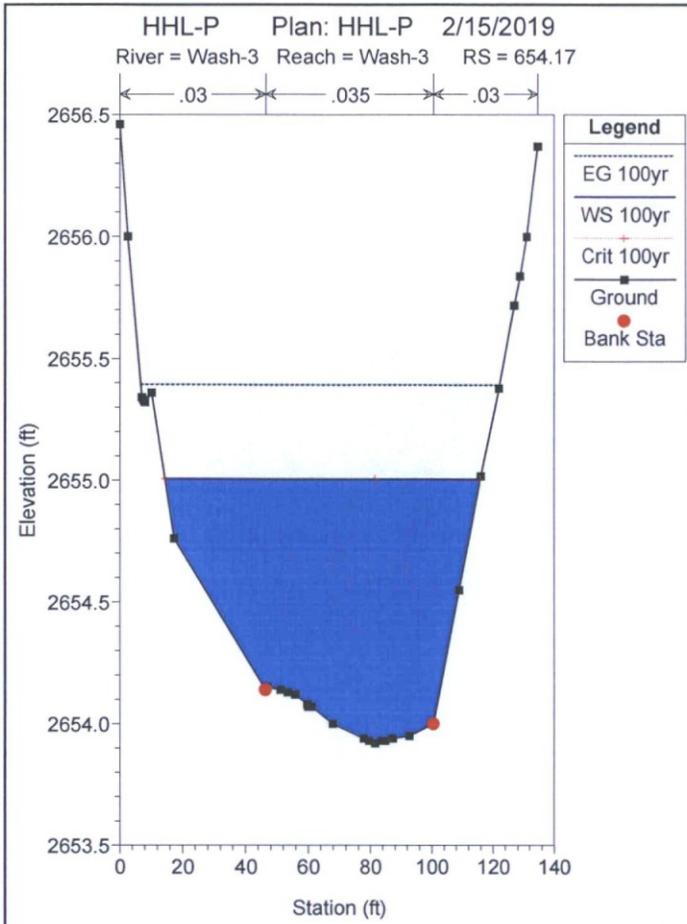
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Wash-4_Reach-3	Wash-4_Reach-3	45.77	100yr	173.00	2667.17	2668.34	2668.34	2668.67	0.019285	4.62	38.19	61.12	0.98
Wash-4_Reach-3	Wash-4_Reach-3	14.68	100yr	173.00	2666.00	2667.32	2667.32	2667.70	0.020009	4.94	35.07	48.33	1.01
Wash-4_Reach-2	Wash-4_Reach-2	116.45	100yr	58.00	2670.00	2670.68	2670.68	2670.93	0.017834	4.37	14.64	29.20	0.94
Wash-4_Reach-2	Wash-4_Reach-2	49.43	100yr	58.00	2668.00	2668.88	2668.88	2669.12	0.023768	3.95	14.69	31.33	1.02
Wash-4_Reach-1	Wash-4_Reach-1	315.2	100yr	112.00	2675.46	2676.39	2676.39	2676.69	0.019384	4.46	25.69	44.45	0.97
Wash-4_Reach-1	Wash-4_Reach-1	217.96	100yr	112.00	2672.00	2673.27	2673.27	2673.62	0.014055	5.91	24.22	34.55	0.92
Wash-4_Reach-1	Wash-4_Reach-1	146.14	100yr	112.00	2669.99	2671.44		2671.71	0.007674	4.75	27.83	30.24	0.70
Wash-4_Reach-1	Wash-4_Reach-1	84.39	100yr	112.00	2669.86	2670.71	2670.71	2671.03	0.017169	4.73	25.46	41.15	0.94
Wash-3	Wash-3	1587.88	100yr	322.00	2675.75	2677.31	2677.31	2677.84	0.014428	6.51	58.81	66.73	0.96
Wash-3	Wash-3	1227.37	100yr	322.00	2667.95	2670.37		2670.38	0.000120	0.78	434.64	236.70	0.09
Wash-3	Wash-3	1112.54	100yr	322.00	2664.21	2670.37		2670.38	0.000006	0.33	973.10	174.50	0.02
Wash-3	Wash-3	1010.17	100yr	322.00	2662.00	2670.37	2664.43	2670.38	0.000003	0.27	1210.87	162.50	0.02
Wash-3	Wash-3	950		Culvert									
Wash-3	Wash-3	948.9	100yr	322.00	2660.00	2662.74	2662.74	2663.94	0.013050	8.79	36.62	180.30	0.99
Wash-3	Wash-3	905.66	100yr	382.00	2659.96	2660.76	2660.76	2661.10	0.018829	4.74	82.89	125.31	0.98
Wash-3	Wash-3	654.17	100yr	382.00	2653.92	2655.01	2655.01	2655.40	0.015651	5.30	78.20	101.47	0.94
Wash-3	Wash-3	544.6	100yr	382.00	2651.16	2651.94	2651.94	2652.22	0.019564	4.35	92.00	172.31	0.97
Wash-3	Wash-3	489.26	100yr	382.00	2649.54	2650.43		2650.54	0.008237	2.74	140.34	244.71	0.62
Wash-3	Wash-3	404.37	100yr	382.00	2647.98	2649.20	2649.20	2649.63	0.013832	5.68	74.75	84.58	0.91
Wash-3	Wash-3	246.12	100yr	382.00	2645.88	2646.63	2646.63	2646.95	0.020062	4.54	85.32	136.60	0.99
Wash-3	Wash-3	92.28	100yr	382.00	2641.97	2642.93	2642.93	2643.21	0.015266	4.46	93.70	164.04	0.89
Wash-2	Wash-2	1305.43	100yr	63.00	2679.87	2680.71	2680.71	2681.02	0.016850	4.68	14.54	23.82	0.93
Wash-2	Wash-2	1219.1	100yr	63.00	2675.80	2676.95	2676.95	2677.32	0.014769	5.33	13.29	17.88	0.92
Wash-2	Wash-2	1130.27	100yr	63.00	2671.99	2673.36	2673.36	2673.75	0.013589	6.09	13.03	16.73	0.92
Wash-2	Wash-2	1008.19	100yr	63.00	2667.87	2668.94	2668.94	2669.30	0.015141	5.24	13.60	19.38	0.92
Wash-2	Wash-2	937.34	100yr	63.00	2664.61	2669.14		2669.14	0.000041	0.74	112.25	46.94	0.06
Wash-2	Wash-2	916.43	100yr	63.00	2663.97	2669.14	2665.12	2669.14	0.000016	0.50	172.95	68.75	0.04
Wash-2	Wash-2	910		Culvert									
Wash-2	Wash-2	858.28	100yr	63.00	2663.83	2664.46	2664.46	2664.71	0.020411	4.08	16.09	33.69	0.97
Wash-2	Wash-2	840.21	100yr	63.00	2662.00	2663.32	2663.31	2663.68	0.014404	6.12	13.41	18.92	0.94
Wash-2	Wash-2	669.5	100yr	63.00	2659.88	2660.66	2660.66	2660.95	0.017516	4.53	15.09	27.07	0.94
Wash-2	Wash-2	455.99	100yr	63.00	2653.52	2654.27	2654.27	2654.51	0.020094	4.09	16.01	33.36	0.96
Wash-2	Wash-2	313.37	100yr	63.00	2647.99	2648.29	2648.28	2648.39	0.020837	2.59	24.97	101.13	0.87
Wash-2	Wash-2	129.33	100yr	63.00	2643.47	2644.21	2644.21	2644.39	0.022770	3.14	19.13	55.60	0.94
Wash-1	Wash-1	563.56	100yr	199.00	2675.98	2677.00	2677.00	2677.45	0.017187	5.47	37.73	42.90	0.96
Wash-1	Wash-1	472.63	100yr	199.00	2673.98	2675.33	2675.33	2675.69	0.013592	6.03	42.95	60.14	0.92
Wash-1	Wash-1	378.71	100yr	199.00	2670.89	2672.04	2672.04	2672.42	0.014674	5.44	41.85	57.00	0.92
Wash-1	Wash-1	215.74	100yr	199.00	2665.58	2666.57	2666.57	2666.93	0.016699	5.13	42.15	60.67	0.95
Wash-1	Wash-1	19.72	100yr	199.00	2659.52	2660.36	2660.36	2660.62	0.022015	4.11	48.99	97.58	1.00

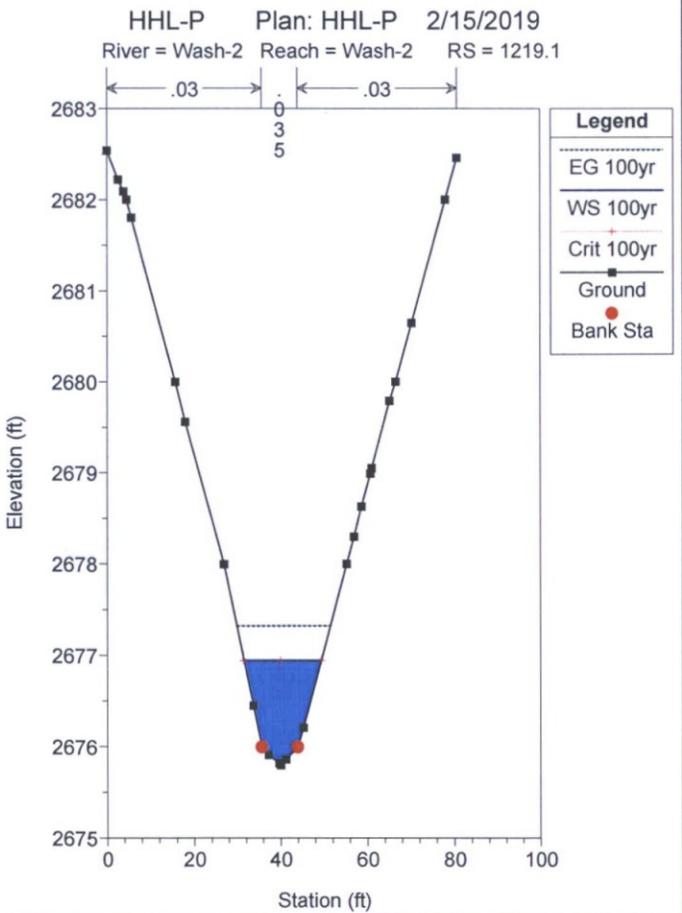
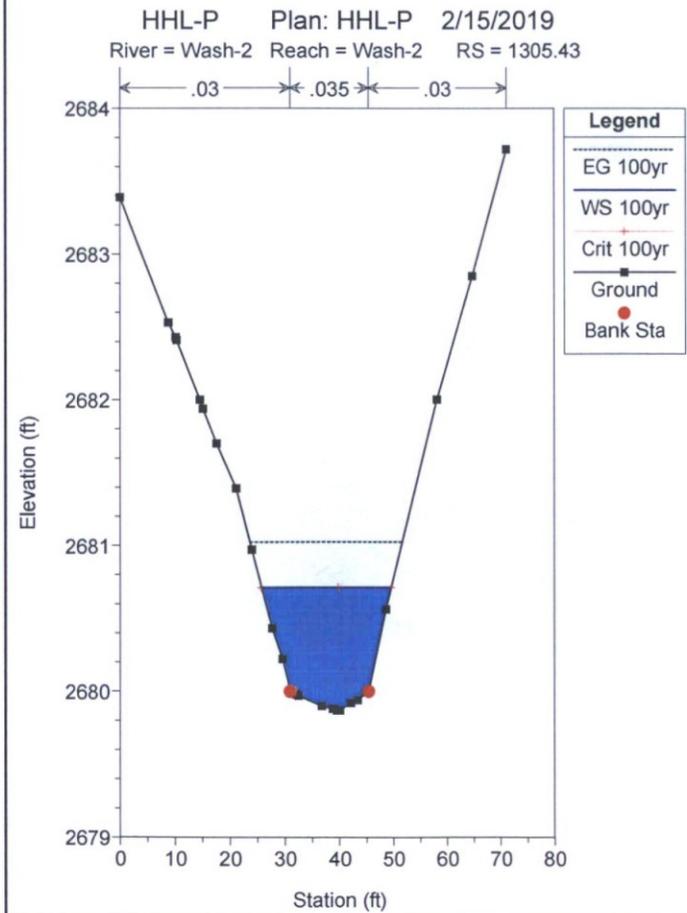
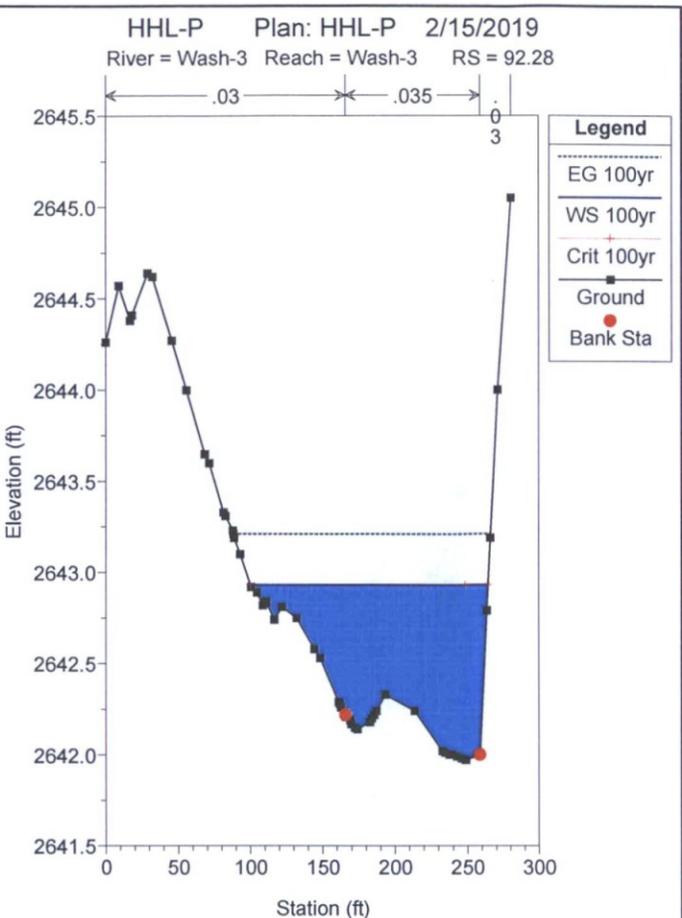
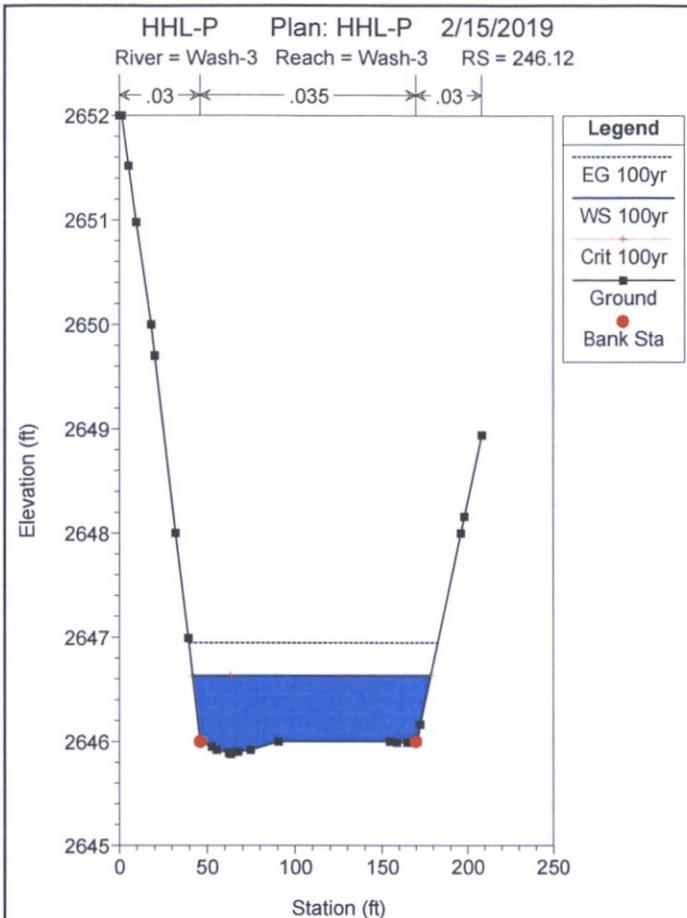


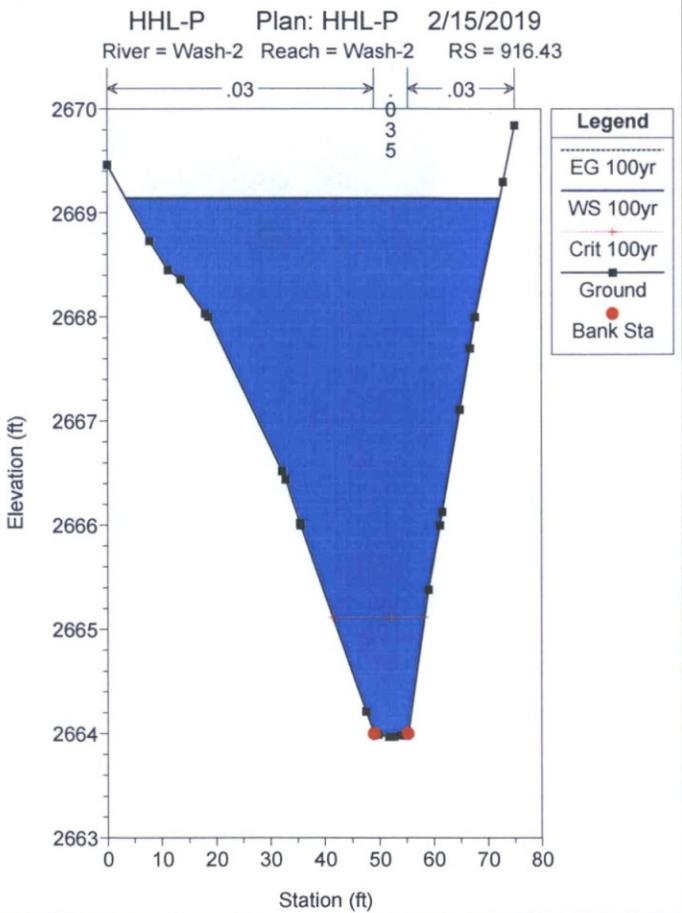
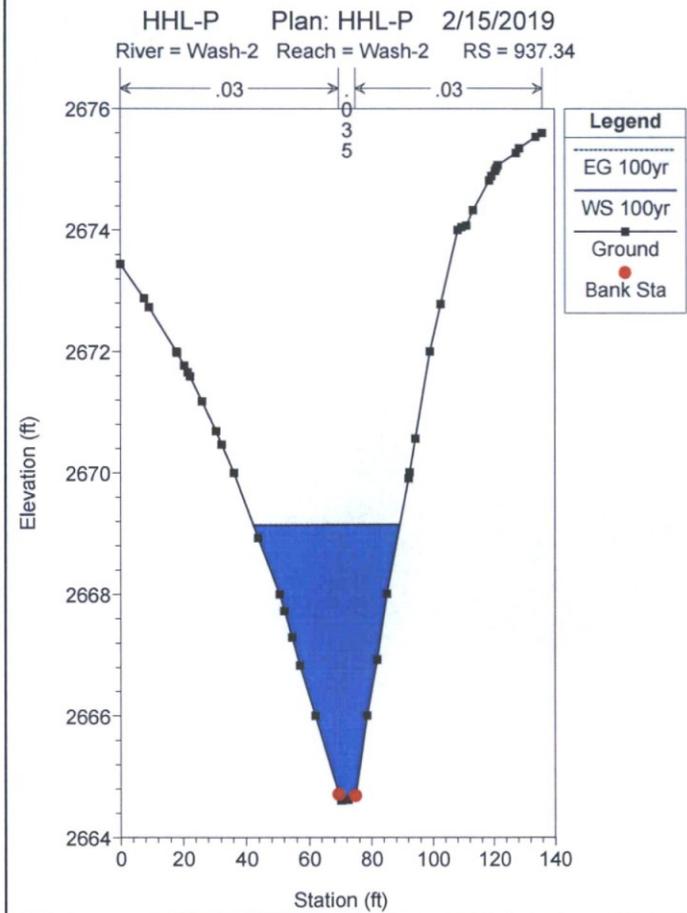
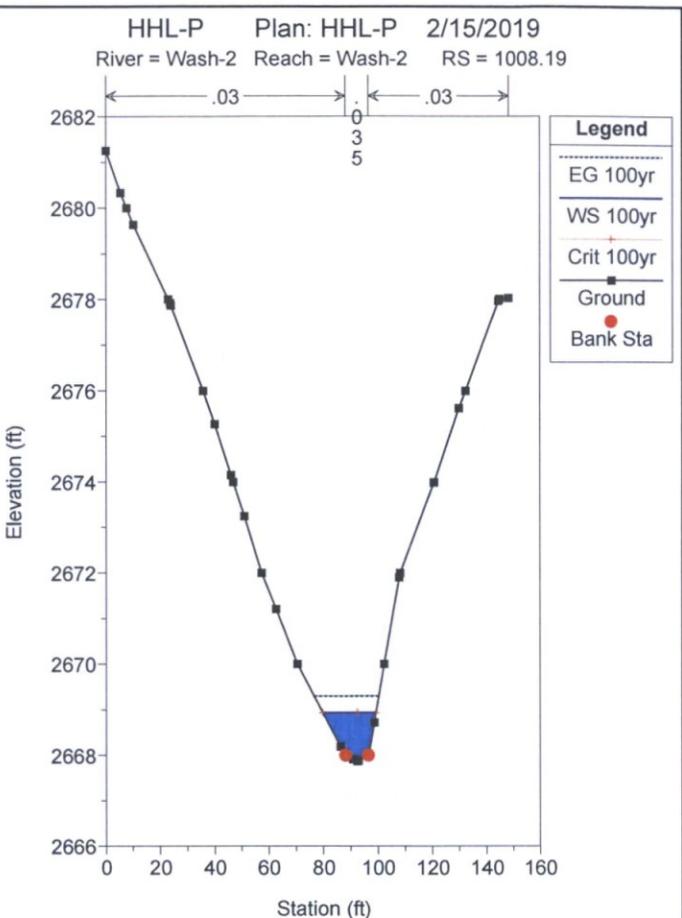
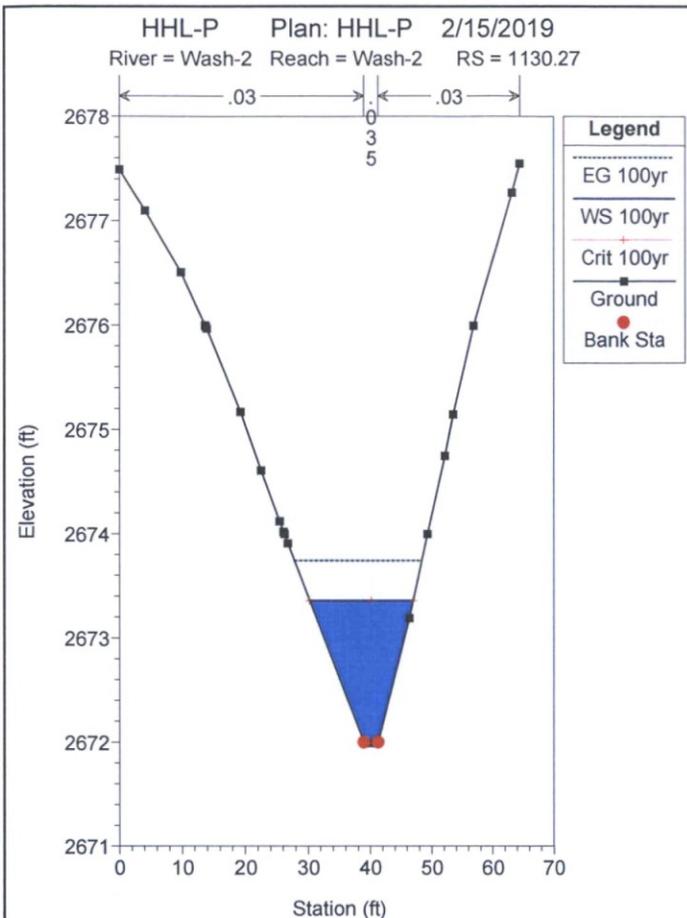


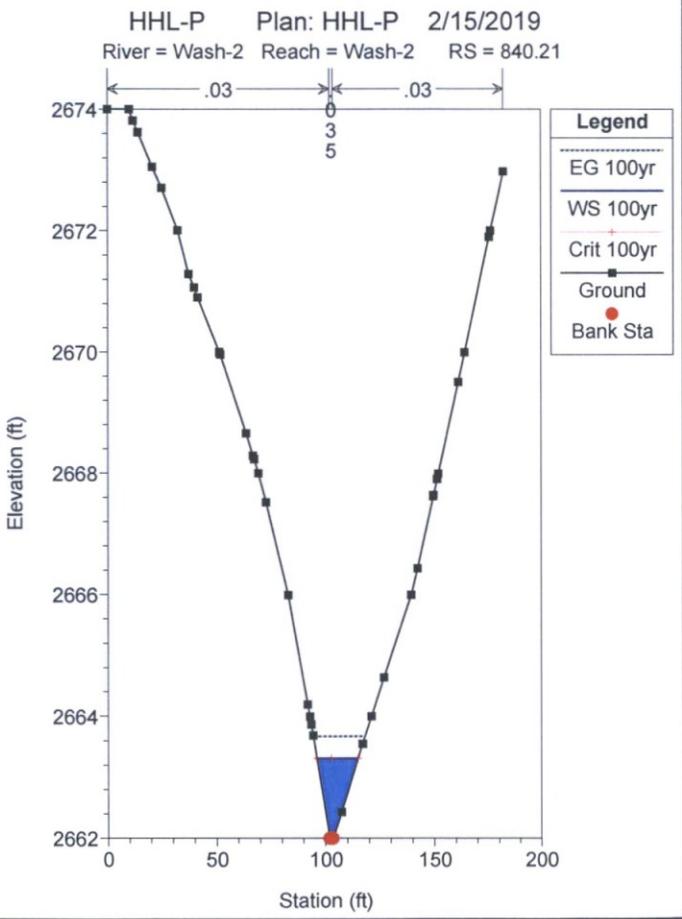
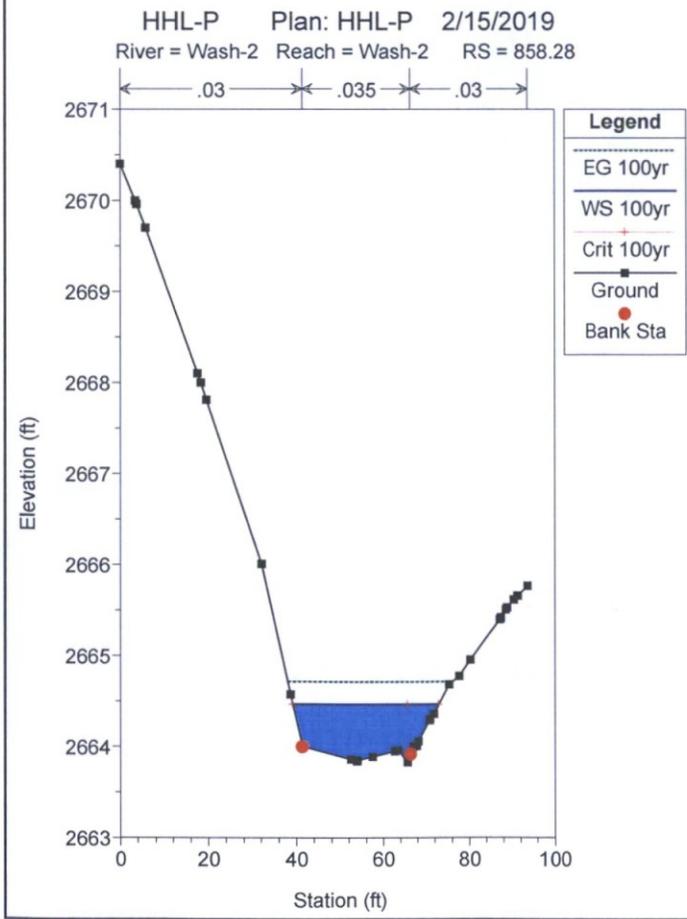
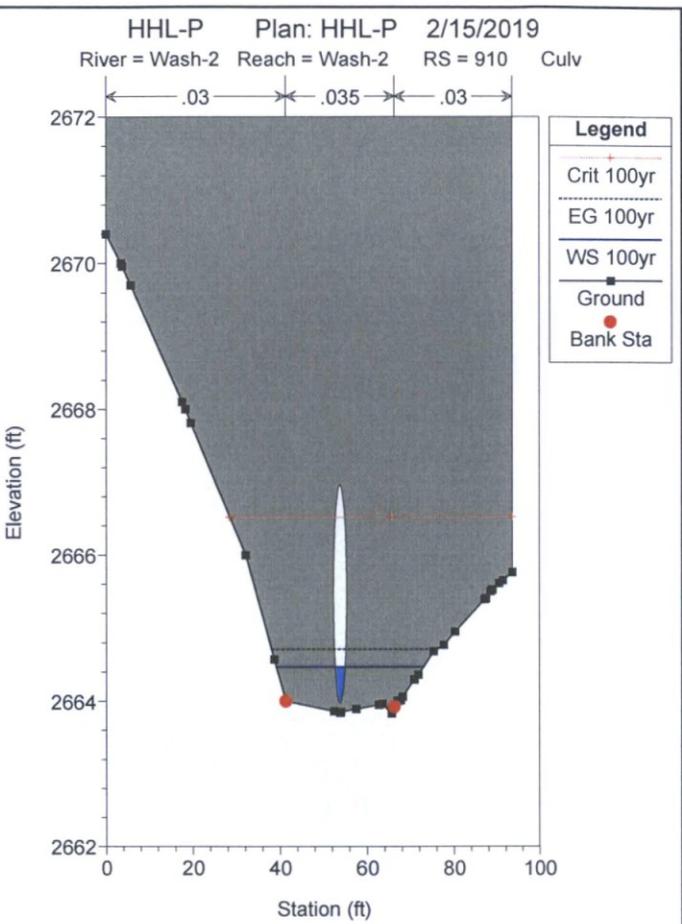
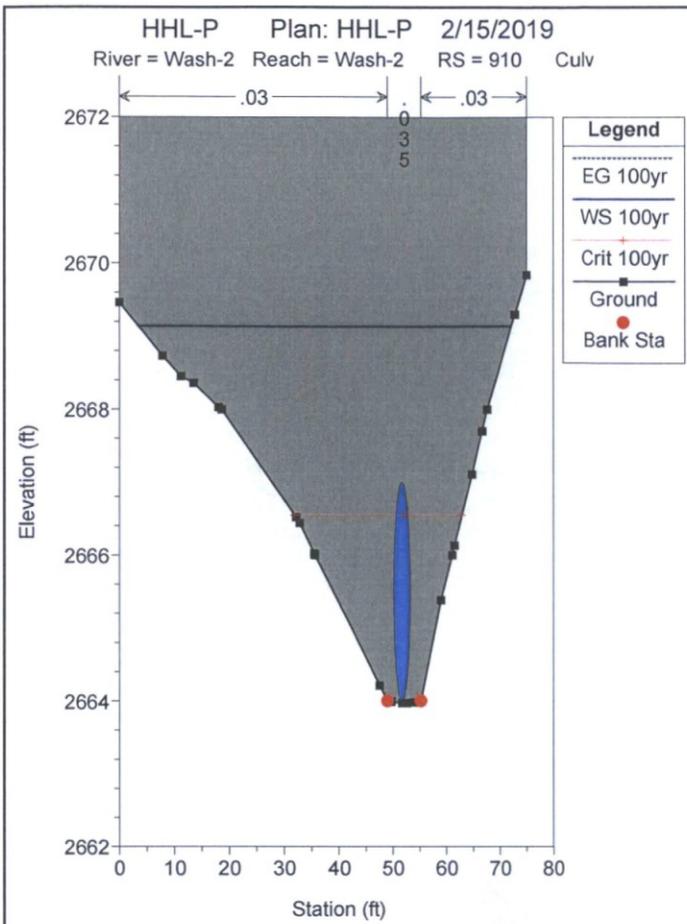




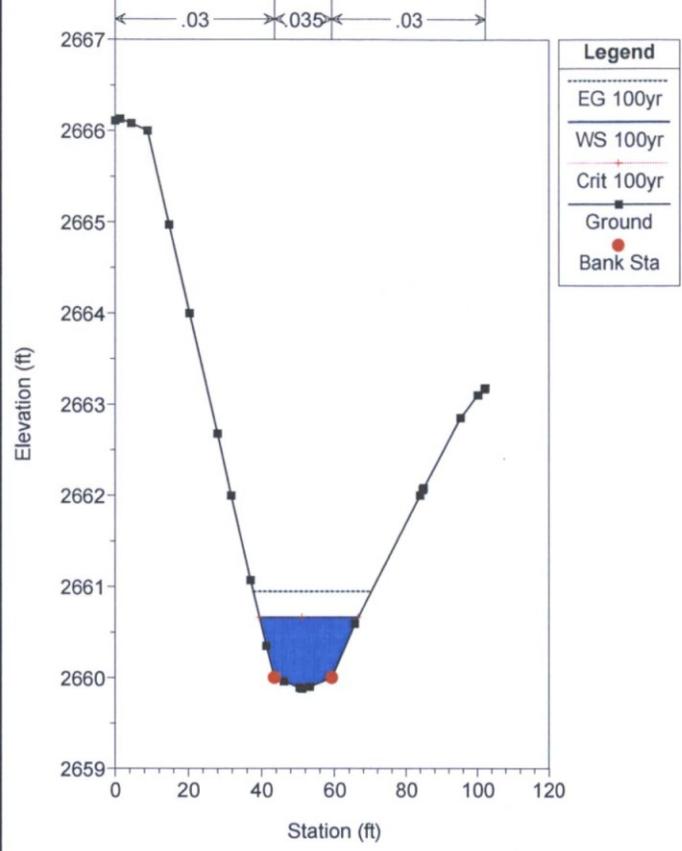




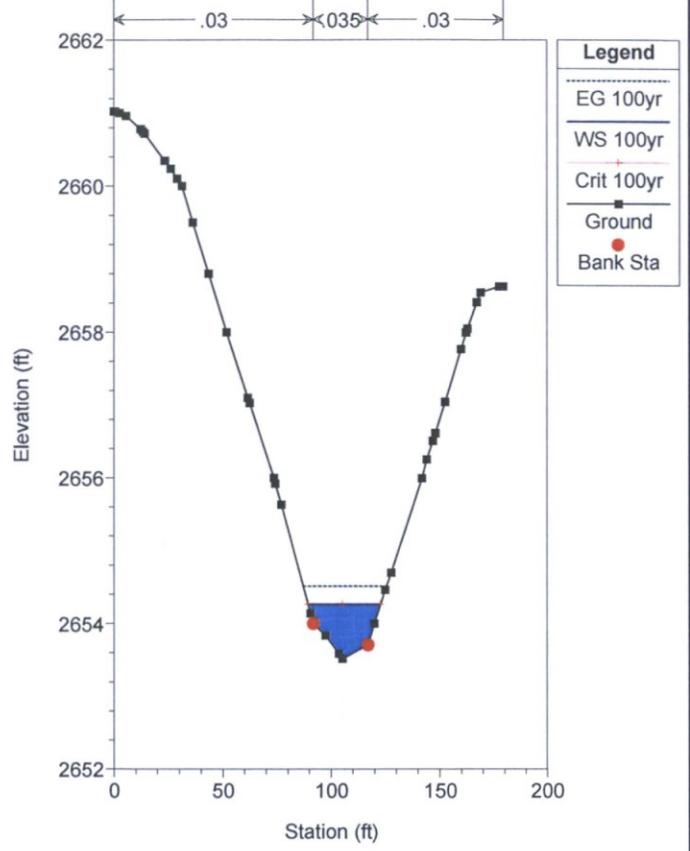




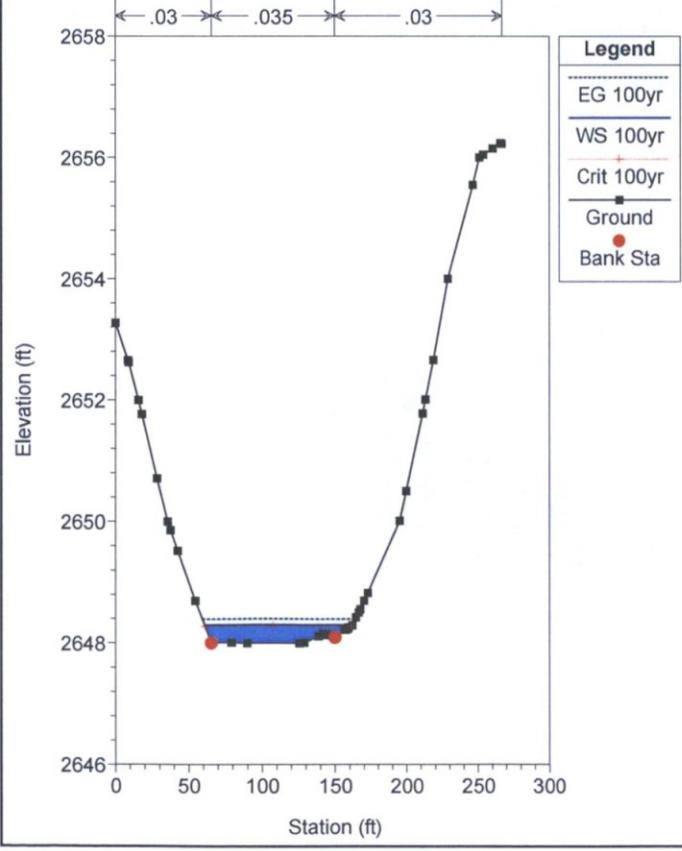
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 River = Wash-2 Reach = Wash-2 RS = 669.5



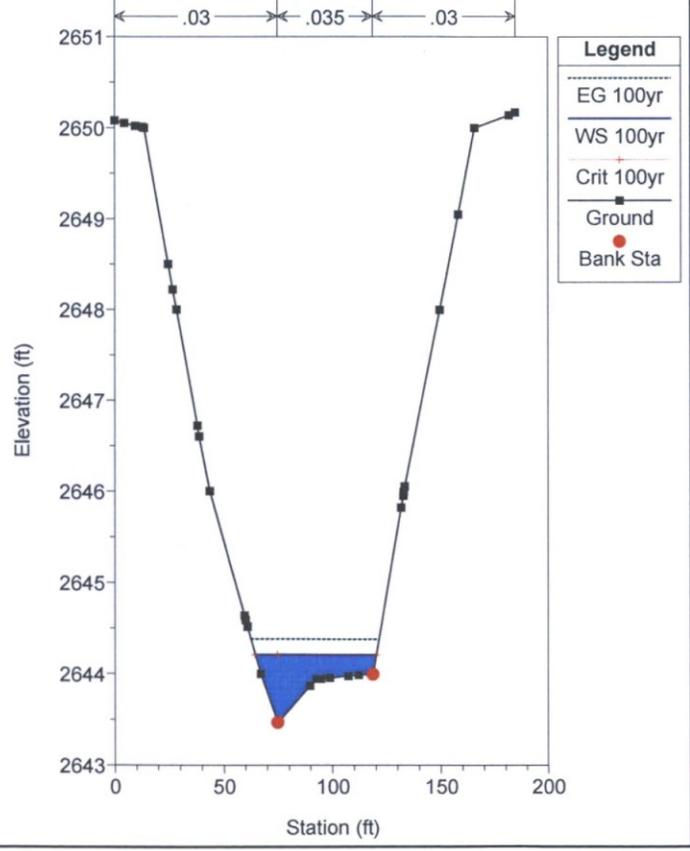
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 River = Wash-2 Reach = Wash-2 RS = 455.99

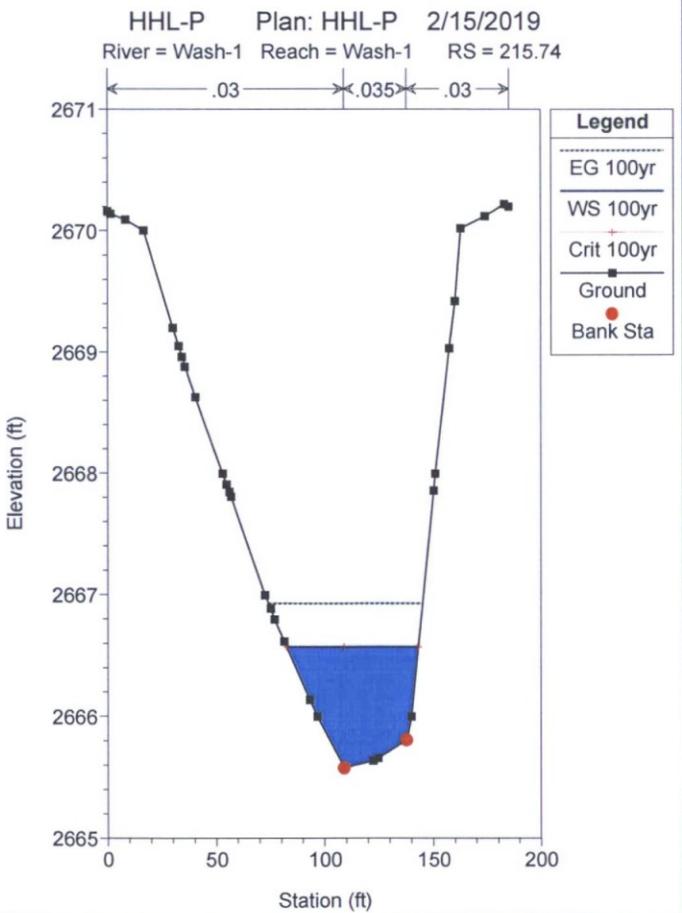
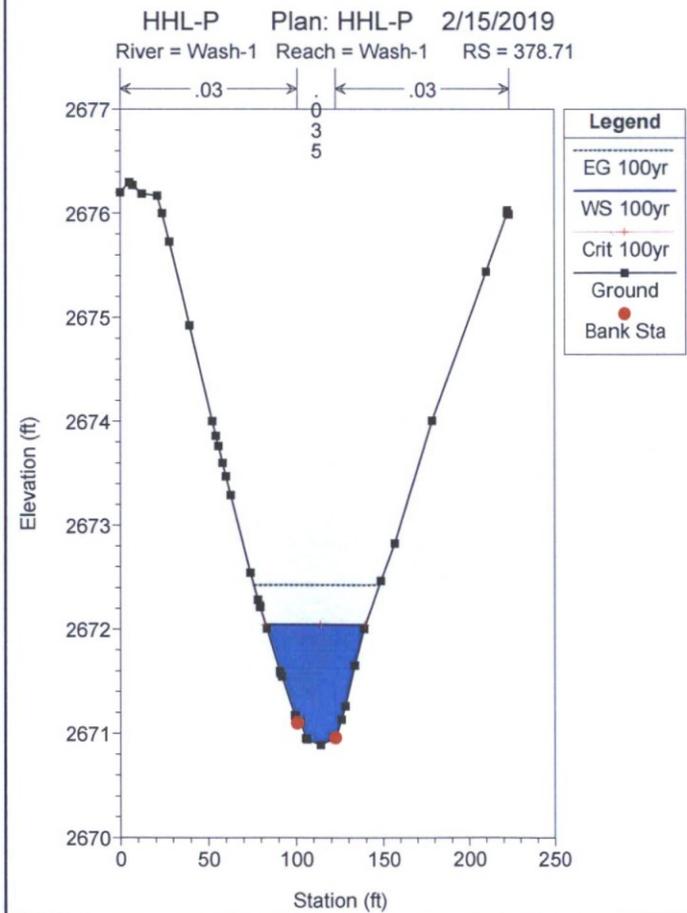
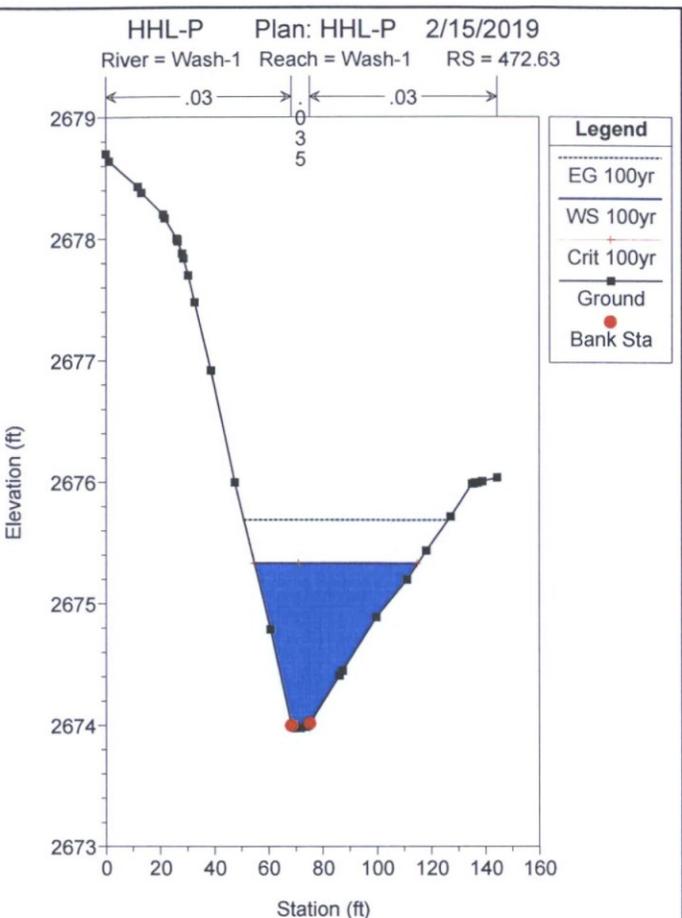
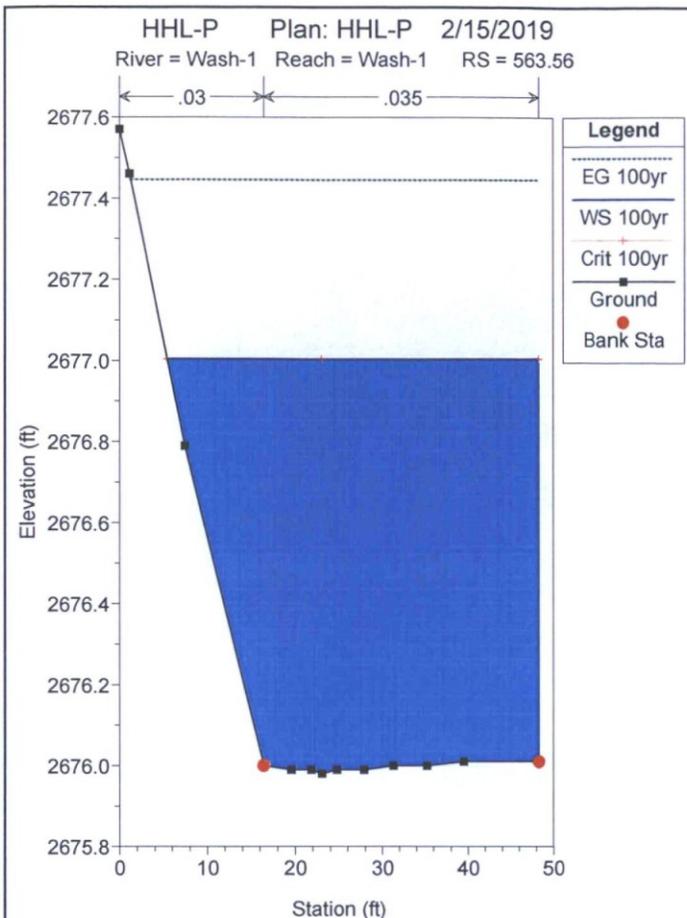


HHL-P Plan: HHL-P 2/15/2019
 River = Wash-2 Reach = Wash-2 RS = 313.37



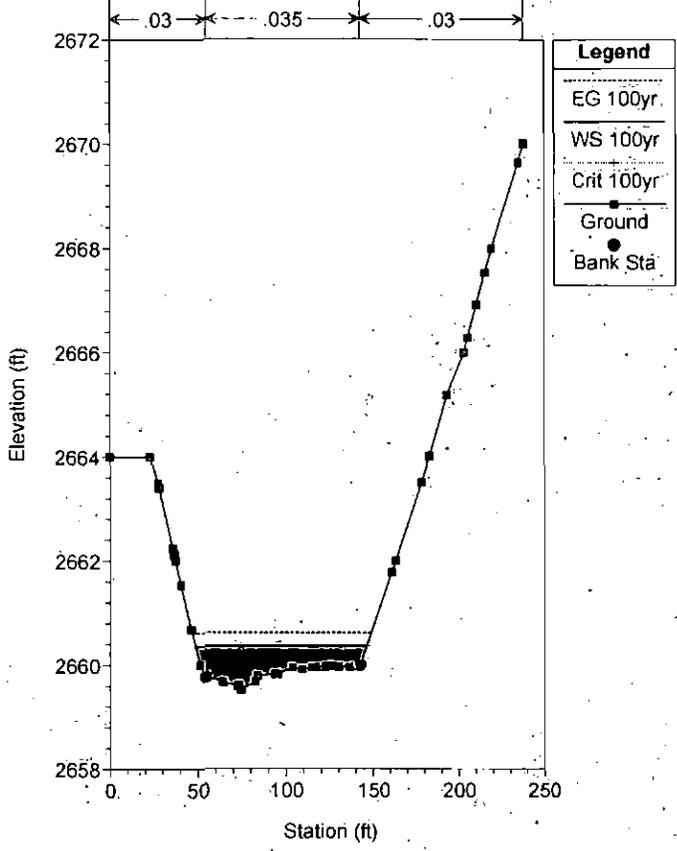
HHL-P Plan: HHL-P 2/15/2019
 River = Wash-2 Reach = Wash-2 RS = 129.33





HHL-P Plan: HHL-P 2/15/2019

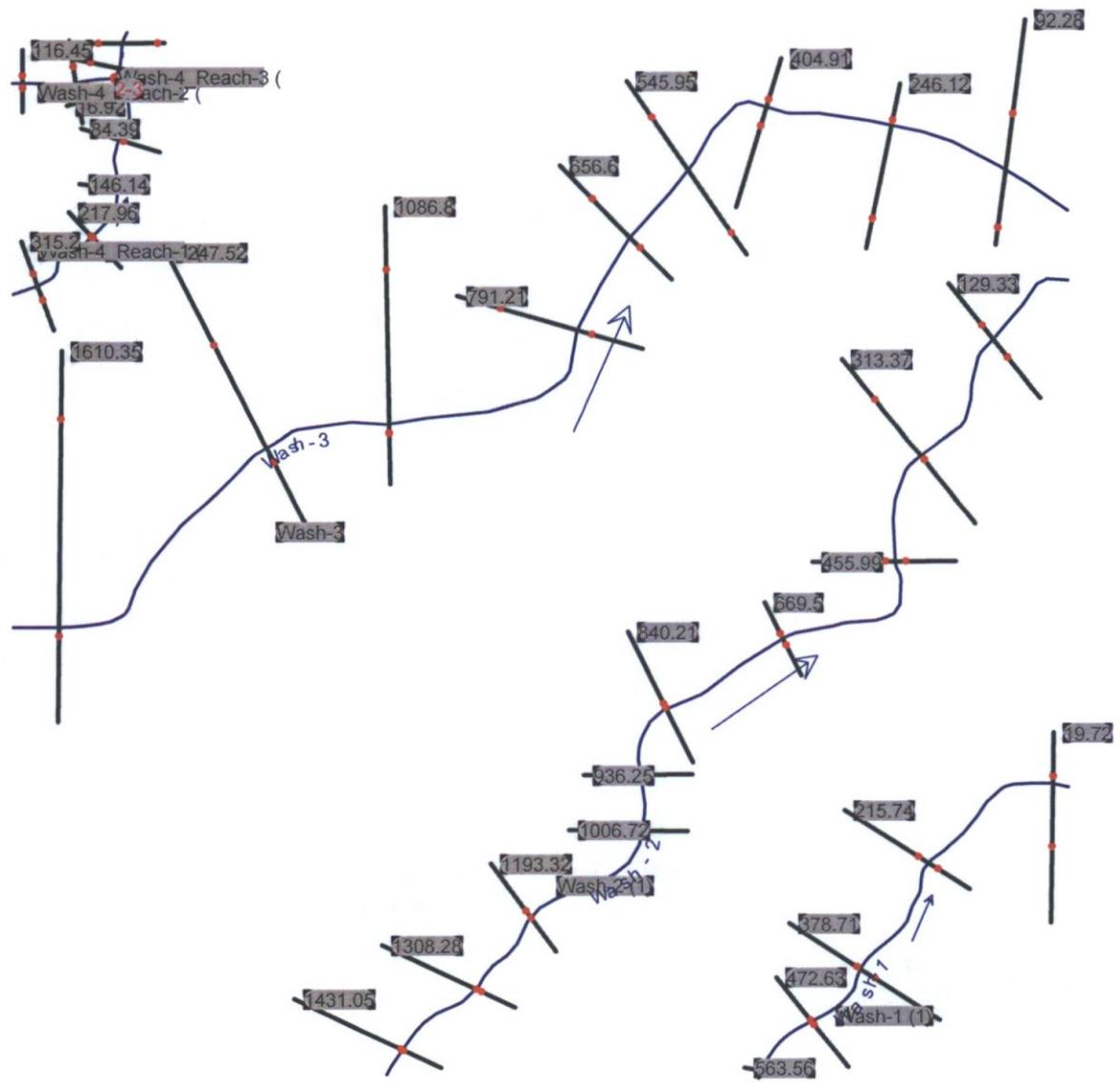
River = Wash-1 Reach = Wash-1 RS = 19.72





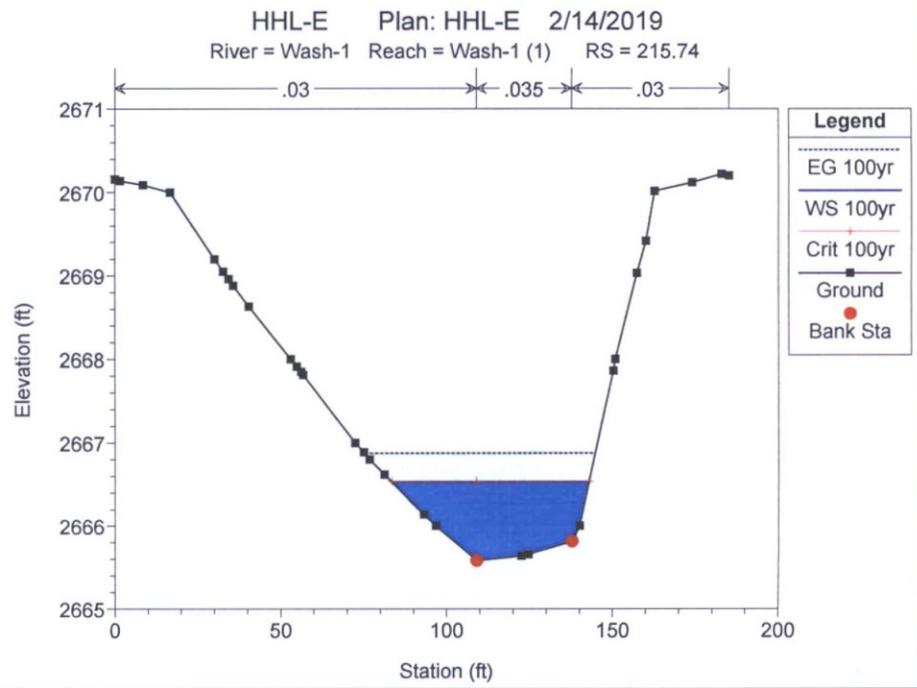
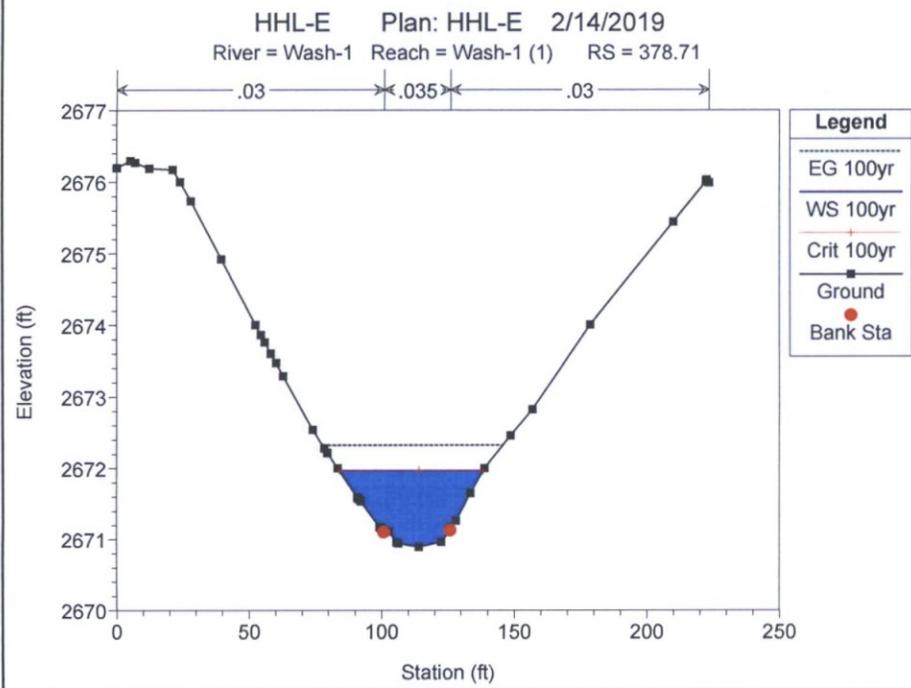
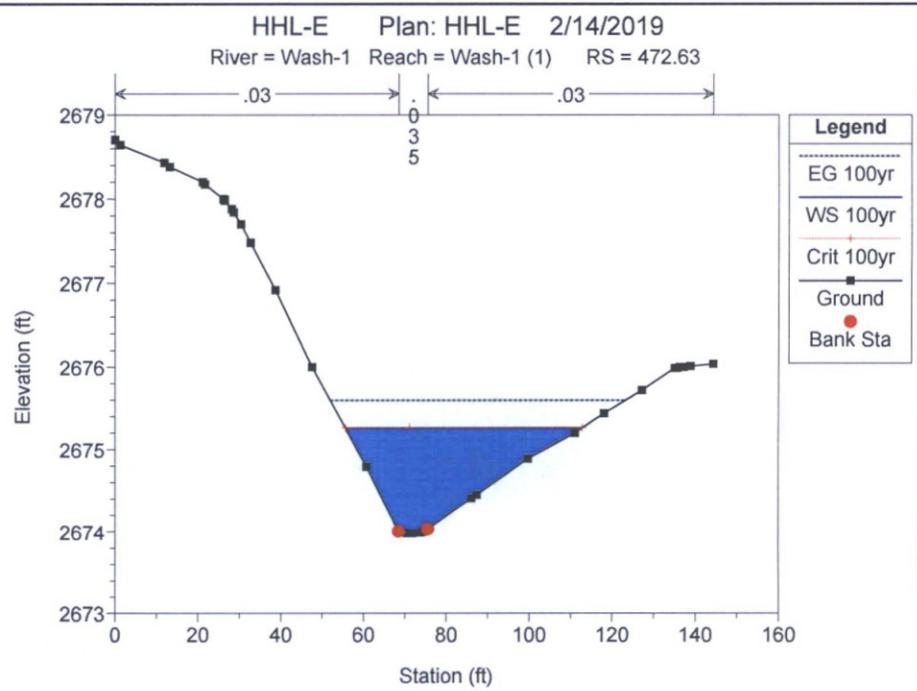
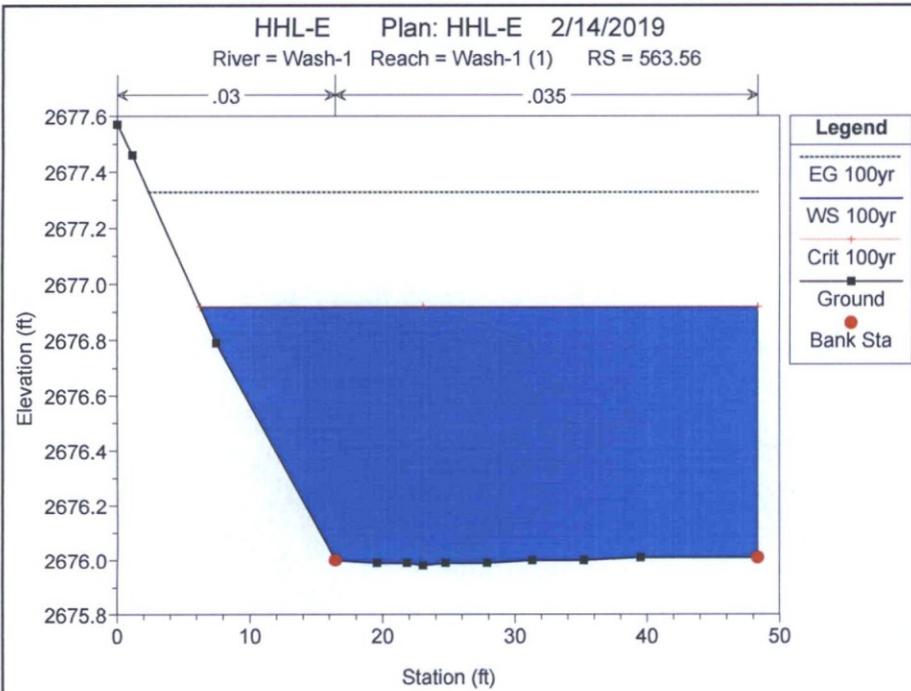
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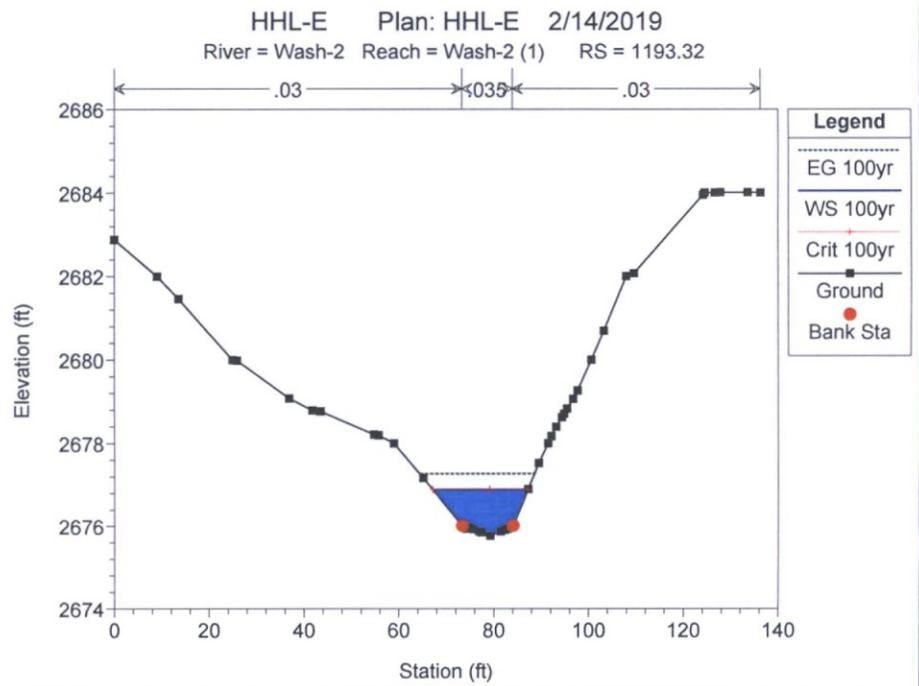
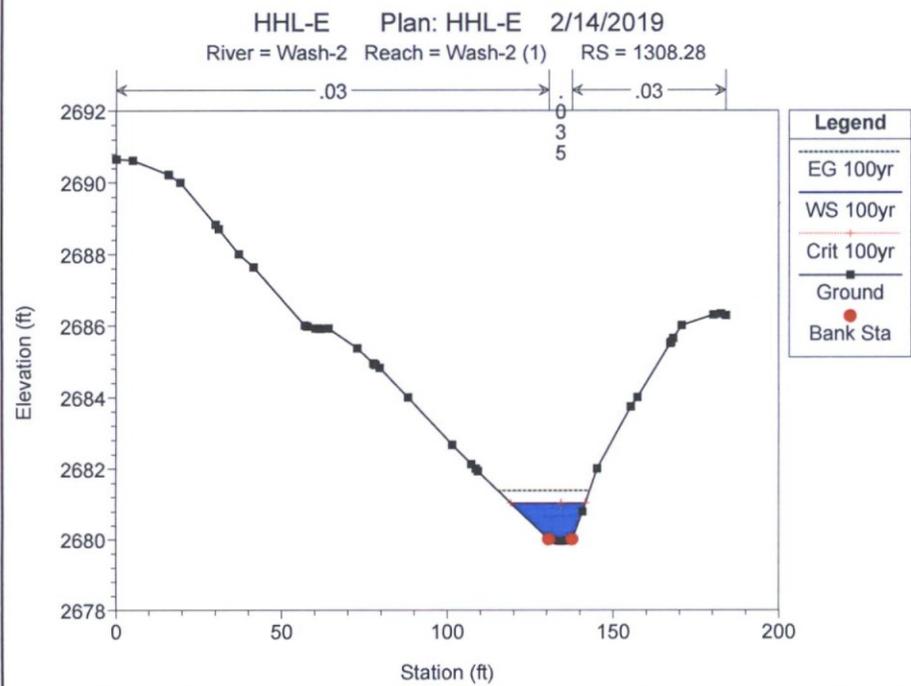
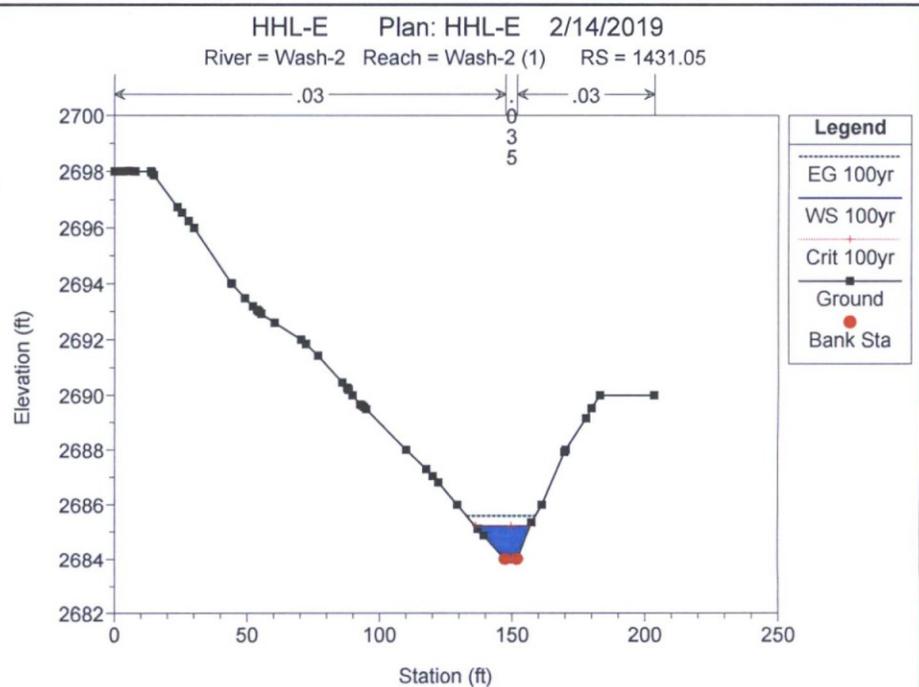
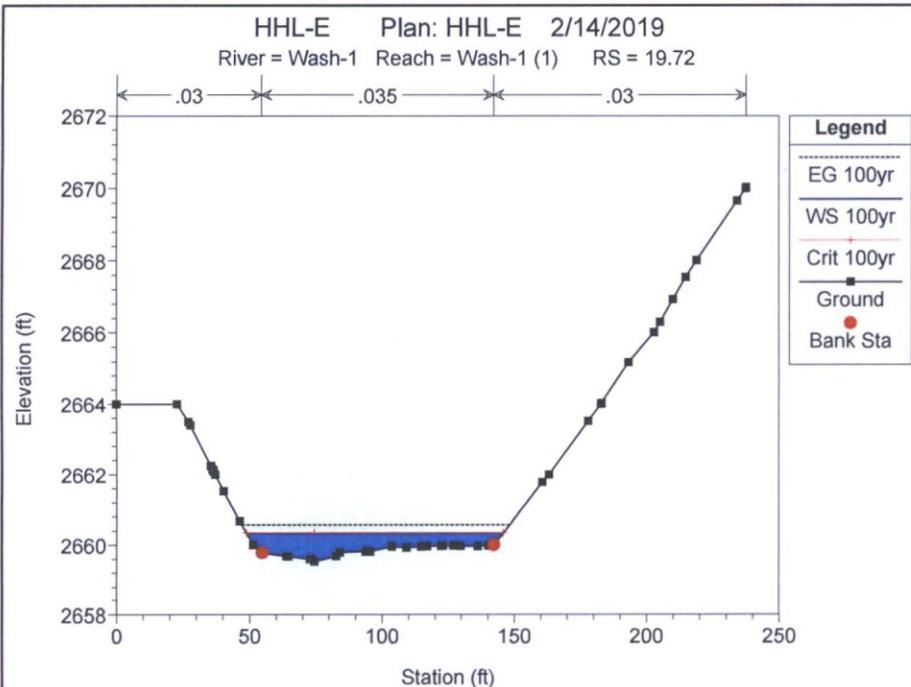
Existing HEC-RAS Model

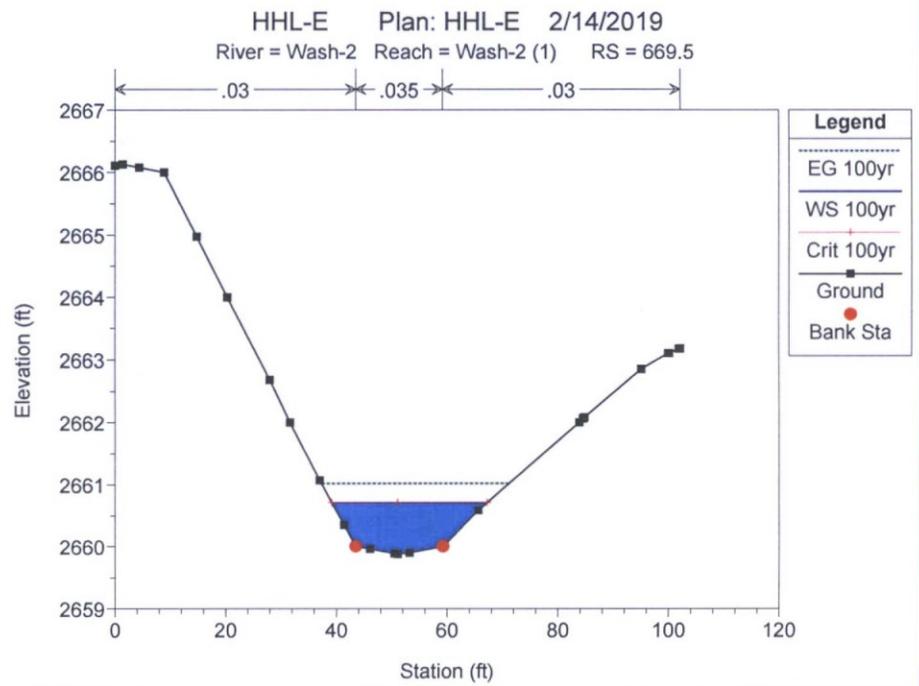
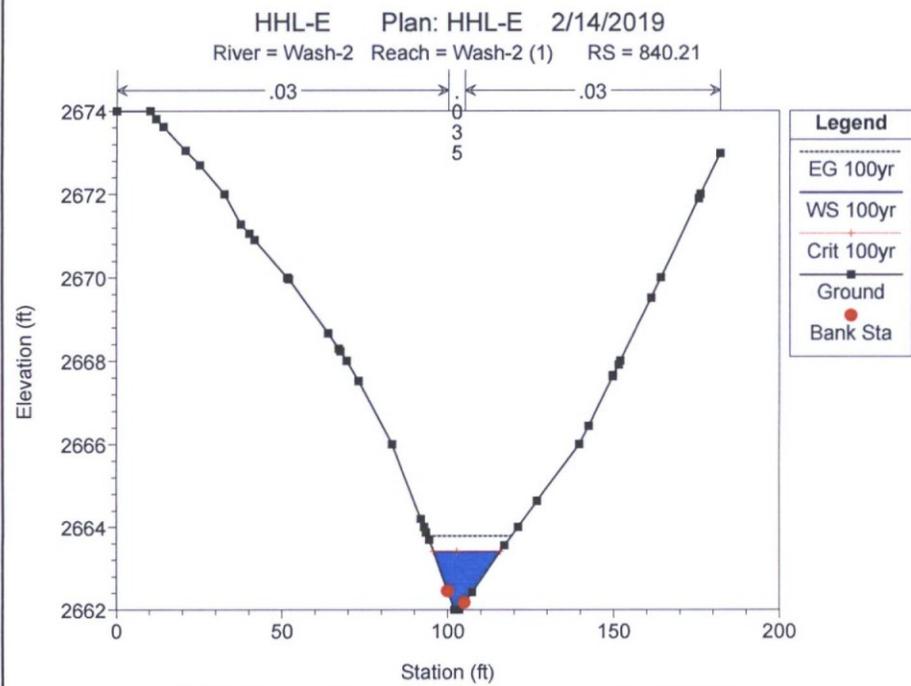
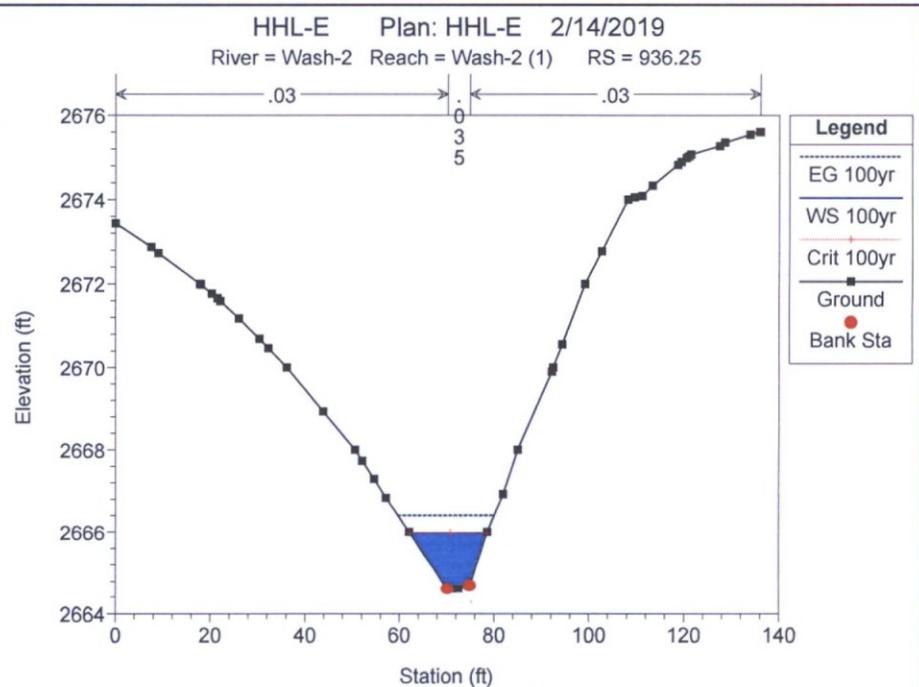
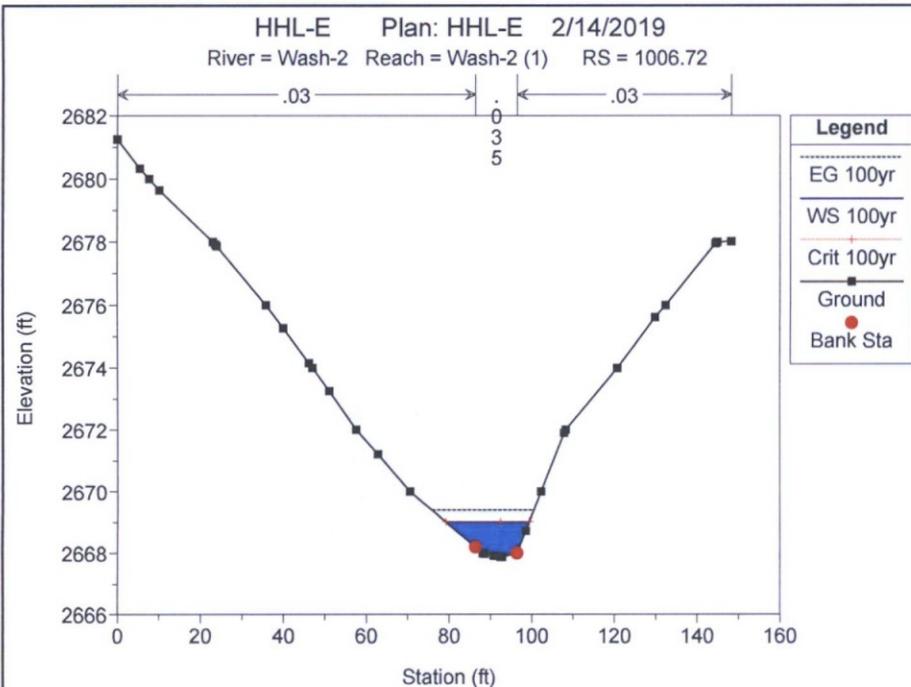


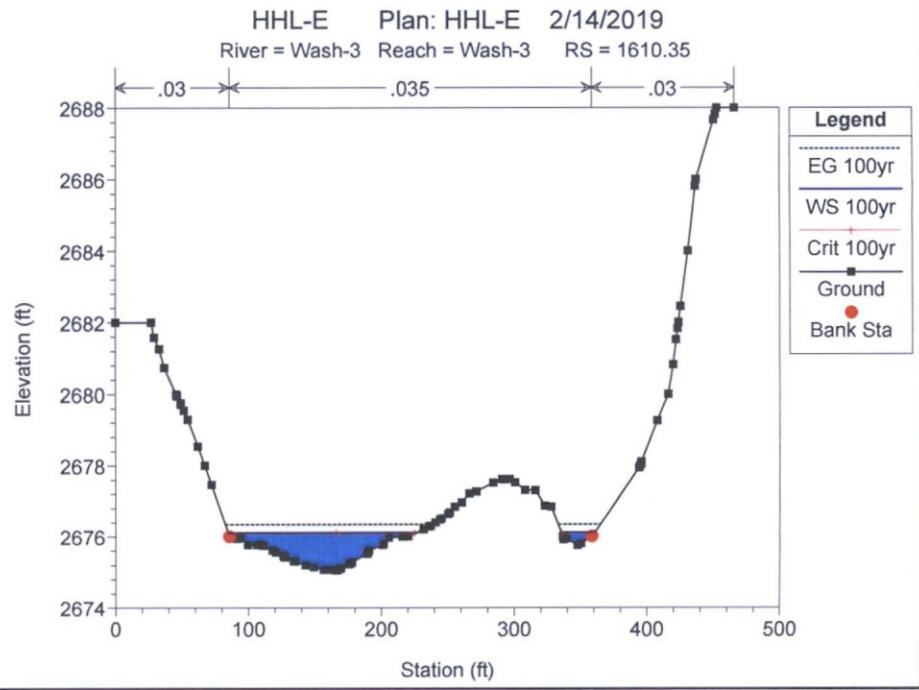
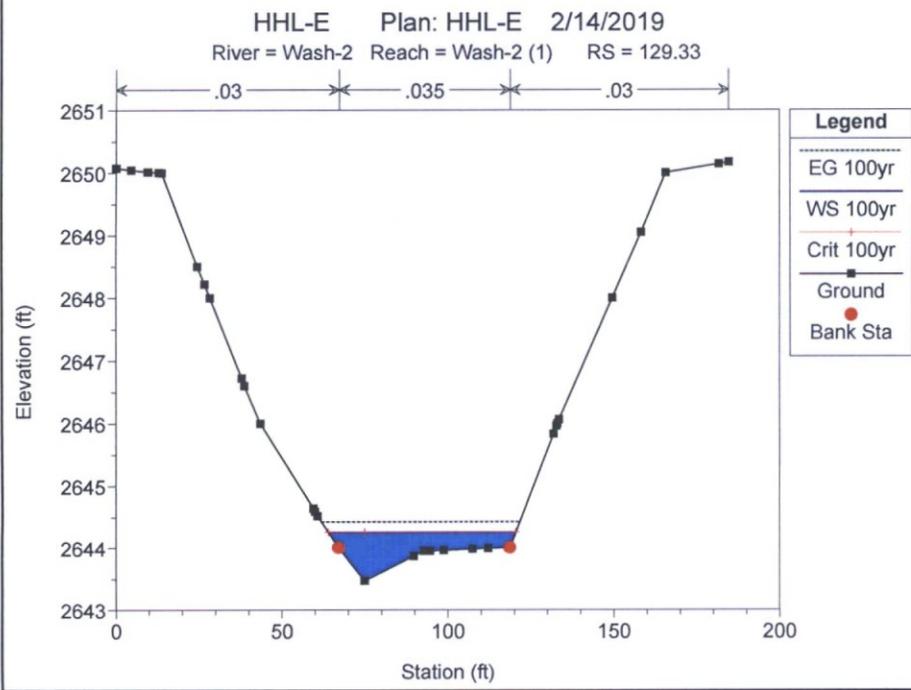
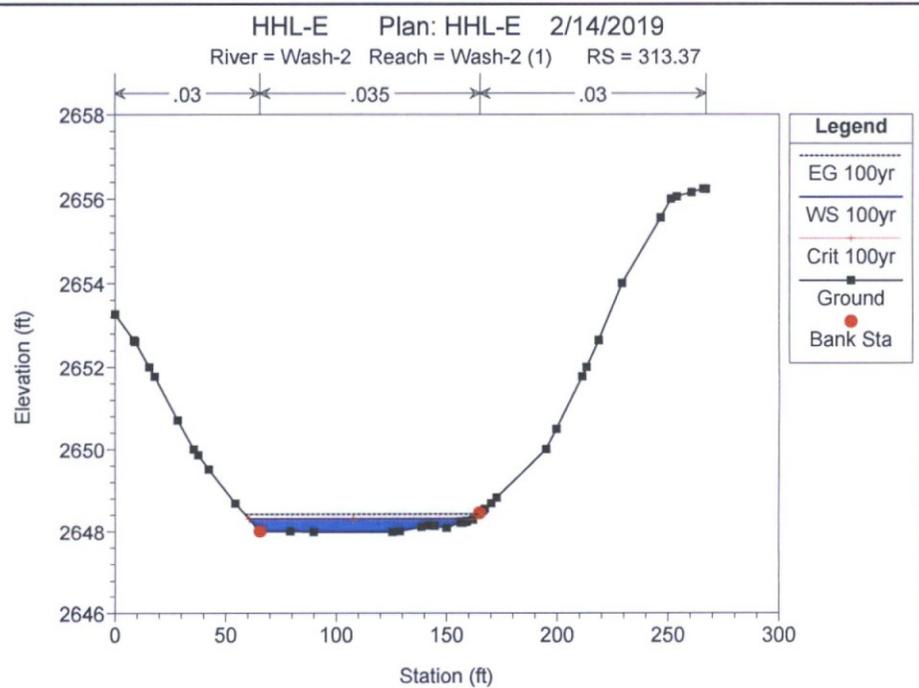
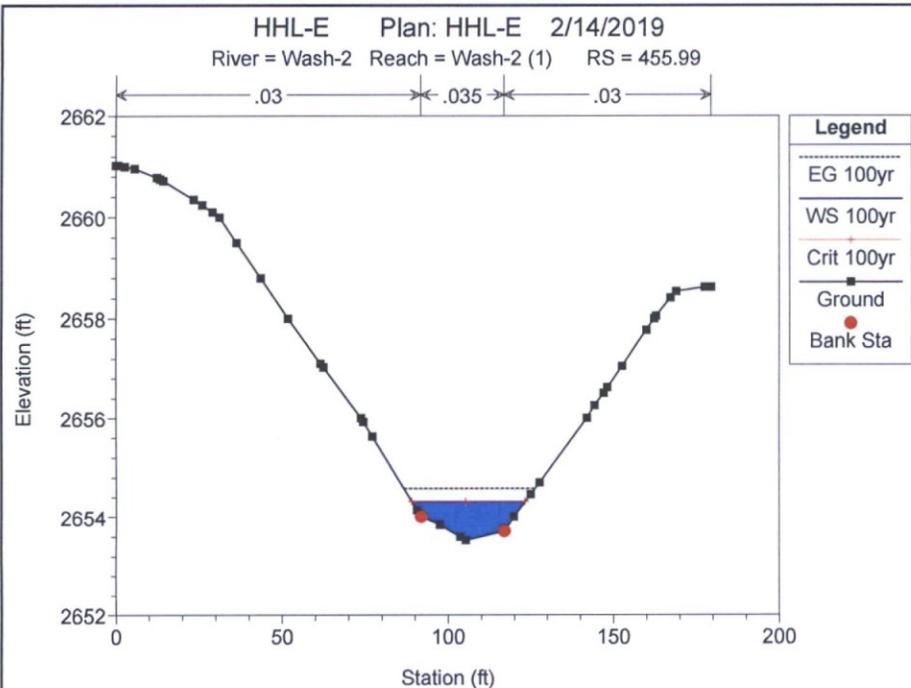
HEC-RAS Plan: Ex Profile: 100yr

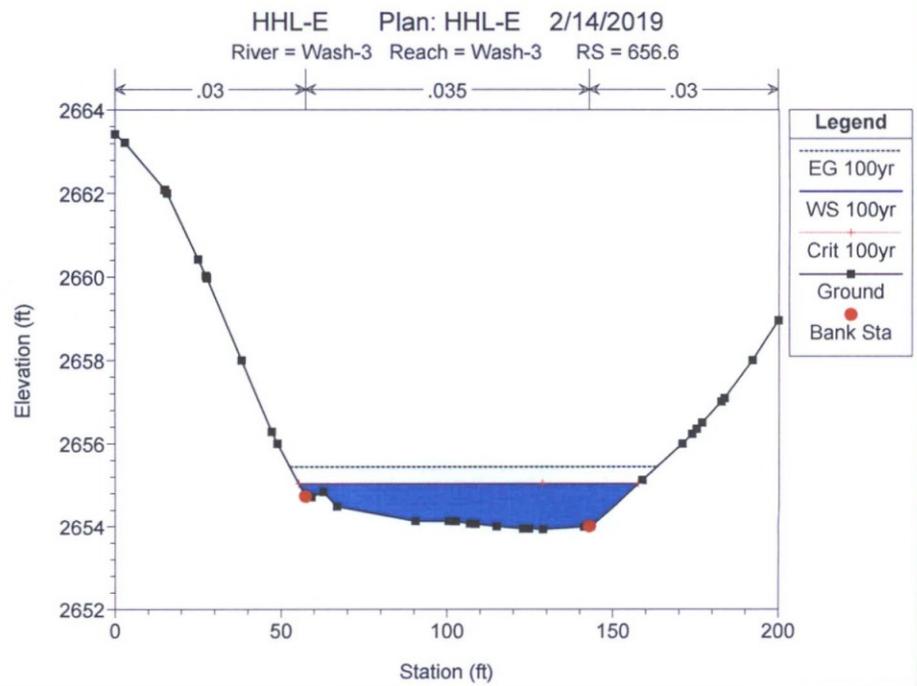
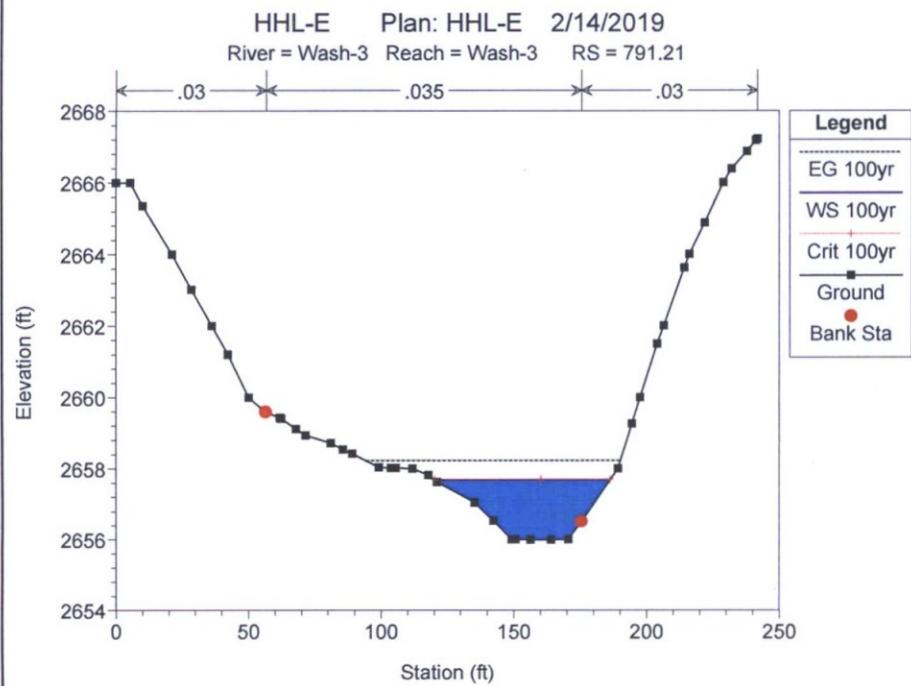
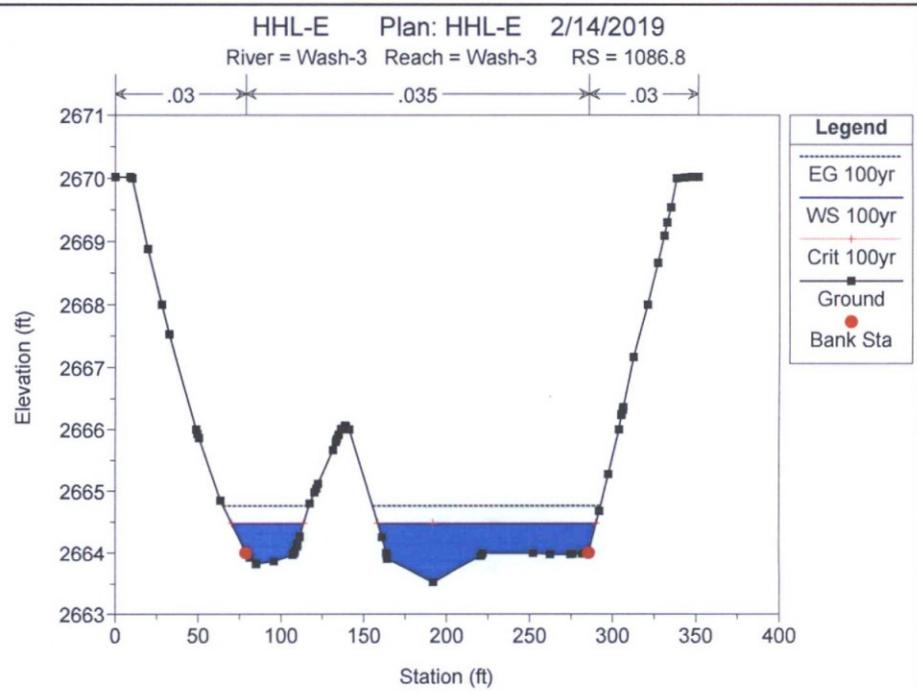
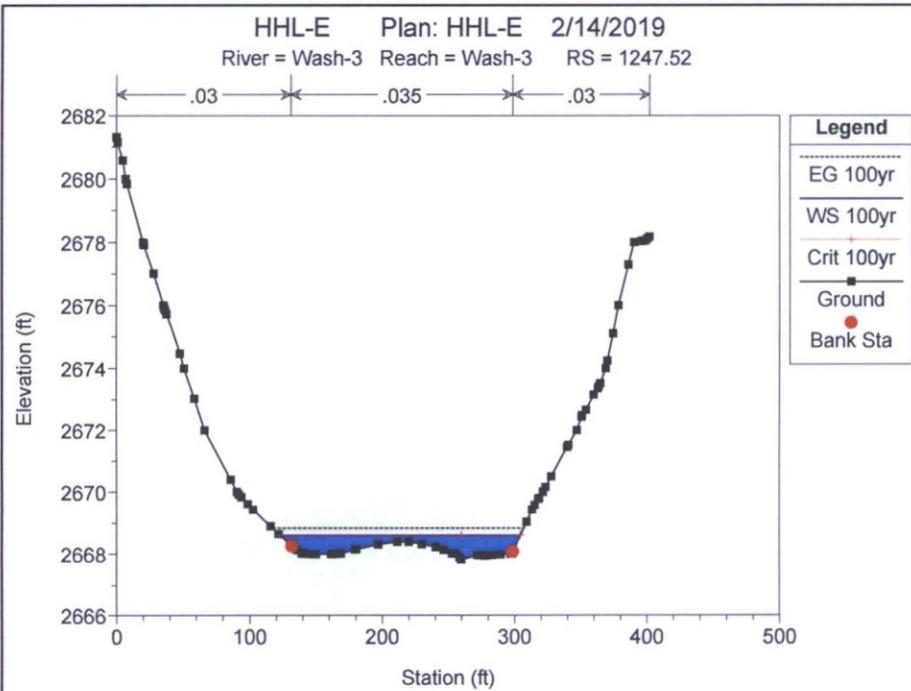
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Wash-4_Reach-3	Wash-4_Reach-3 (	45.77	100yr	176.00	2667.17	2668.35	2668.35	2668.68	0.019458	4.67	38.49	61.24	0.98
Wash-4_Reach-3	Wash-4_Reach-3 (	14.68	100yr	176.00	2666.00	2667.33	2667.33	2667.71	0.020314	4.92	35.74	48.61	1.01
Wash-4_Reach-2	Wash-4_Reach-2 (	116.45	100yr	58.00	2670.00	2670.68	2670.68	2670.94	0.017471	4.33	14.74	29.27	0.93
Wash-4_Reach-2	Wash-4_Reach-2 (	49.43	100yr	58.00	2668.00	2668.88	2668.88	2669.12	0.023768	3.95	14.69	31.33	1.02
Wash-4_Reach-1	Wash-4_Reach-1 (	315.2	100yr	112.00	2675.46	2676.39	2676.39	2676.69	0.019125	4.49	25.86	44.52	0.97
Wash-4_Reach-1	Wash-4_Reach-1 (	217.96	100yr	112.00	2672.00	2673.27	2673.27	2673.62	0.014055	5.91	24.22	34.55	0.92
Wash-4_Reach-1	Wash-4_Reach-1 (	146.14	100yr	112.00	2669.99	2671.44		2671.71	0.007657	4.75	27.86	30.26	0.70
Wash-4_Reach-1	Wash-4_Reach-1 (	84.39	100yr	112.00	2669.86	2670.71	2670.71	2671.03	0.017169	4.73	25.46	41.15	0.94
Wash-4_Reach-1	Wash-4_Reach-1 (	16.92	100yr	112.00	2667.94	2668.83	2668.83	2669.13	0.015983	4.73	26.24	43.78	0.92
Wash-3	Wash-3	1610.35	100yr	322.00	2675.05	2676.12	2676.08	2676.34	0.018784	3.76	85.76	167.88	0.92
Wash-3	Wash-3	1247.52	100yr	322.00	2667.81	2668.59	2668.59	2668.83	0.022879	3.93	82.91	181.39	1.00
Wash-3	Wash-3	1086.8	100yr	411.00	2663.53	2664.47	2664.47	2664.76	0.021690	4.32	96.17	174.88	1.00
Wash-3	Wash-3	791.21	100yr	411.00	2655.99	2657.68	2657.68	2658.22	0.016401	5.99	70.31	66.11	0.98
Wash-3	Wash-3	656.6	100yr	411.00	2653.93	2655.03	2655.03	2655.44	0.018371	5.17	80.89	102.23	0.99
Wash-3	Wash-3	545.95	100yr	411.00	2651.22	2652.06	2652.06	2652.32	0.021182	4.13	99.97	189.48	0.98
Wash-3	Wash-3	404.91	100yr	411.00	2647.98	2649.27	2649.27	2649.71	0.013908	5.89	80.21	93.82	0.92
Wash-3	Wash-3	246.12	100yr	411.00	2645.88	2646.66	2646.66	2646.99	0.019863	4.65	89.53	137.21	0.99
Wash-3	Wash-3	92.28	100yr	411.00	2641.97	2642.93	2642.93	2643.24	0.019970	4.43	93.98	164.12	0.98
Wash-2	Wash-2 (1)	1431.05	100yr	71.00	2683.99	2685.21	2685.21	2685.58	0.014134	5.74	15.03	20.46	0.92
Wash-2	Wash-2 (1)	1308.28	100yr	71.00	2679.95	2681.04	2681.04	2681.39	0.014737	5.37	15.49	22.50	0.92
Wash-2	Wash-2 (1)	1193.32	100yr	71.00	2675.76	2676.89	2676.89	2677.27	0.015252	5.25	14.88	20.02	0.92
Wash-2	Wash-2 (1)	1006.72	100yr	71.00	2667.87	2669.01	2669.01	2669.39	0.014666	5.30	14.97	20.19	0.91
Wash-2	Wash-2 (1)	936.25	100yr	71.00	2664.61	2665.97	2665.97	2666.40	0.013656	6.01	13.97	16.31	0.92
Wash-2	Wash-2 (1)	840.21	100yr	71.00	2662.00	2663.40	2663.40	2663.79	0.013181	5.72	15.12	20.08	0.89
Wash-2	Wash-2 (1)	669.5	100yr	71.00	2659.88	2660.72	2660.72	2661.02	0.016935	4.67	16.57	28.09	0.93
Wash-2	Wash-2 (1)	455.99	100yr	71.00	2653.52	2654.31	2654.31	2654.58	0.019491	4.24	17.50	34.24	0.96
Wash-2	Wash-2 (1)	313.37	100yr	71.00	2647.99	2648.31	2648.30	2648.42	0.021996	2.64	27.06	101.84	0.89
Wash-2	Wash-2 (1)	129.33	100yr	71.00	2643.47	2644.25	2644.25	2644.43	0.021260	3.37	21.34	56.36	0.94
Wash-1	Wash-1 (1)	563.56	100yr	173.00	2675.98	2676.92	2676.92	2677.33	0.017777	5.25	34.10	42.09	0.97
Wash-1	Wash-1 (1)	472.63	100yr	173.00	2673.98	2675.26	2675.26	2675.60	0.013679	5.82	38.60	57.16	0.91
Wash-1	Wash-1 (1)	378.71	100yr	173.00	2670.89	2671.96	2671.96	2672.32	0.014872	5.18	37.63	54.21	0.91
Wash-1	Wash-1 (1)	215.74	100yr	182.00	2665.58	2666.53	2666.53	2666.87	0.016871	4.99	39.52	59.36	0.95
Wash-1	Wash-1 (1)	19.72	100yr	182.00	2659.52	2660.33	2660.33	2660.57	0.022787	4.01	45.88	97.02	1.00

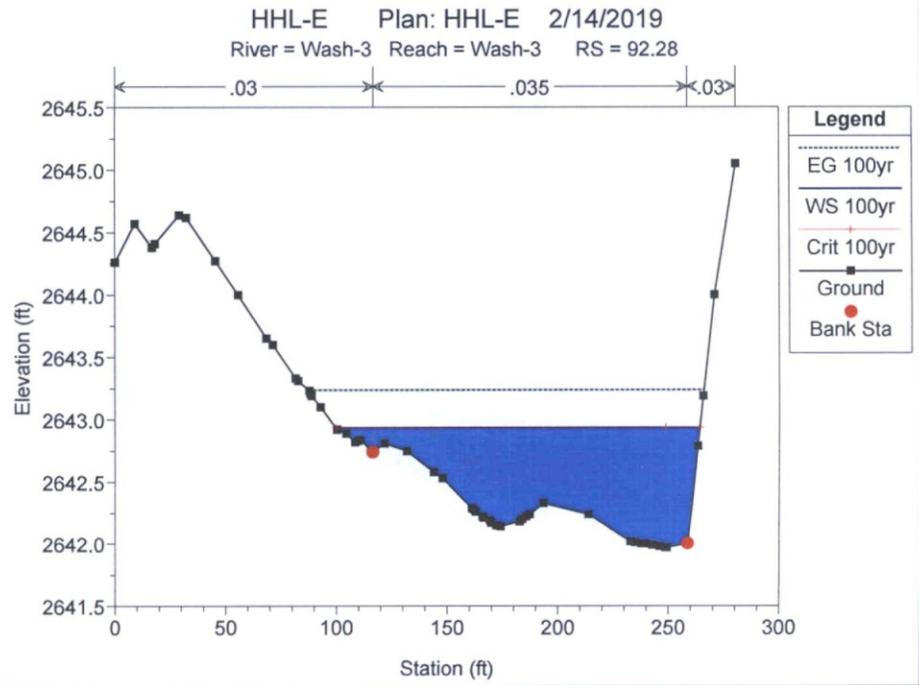
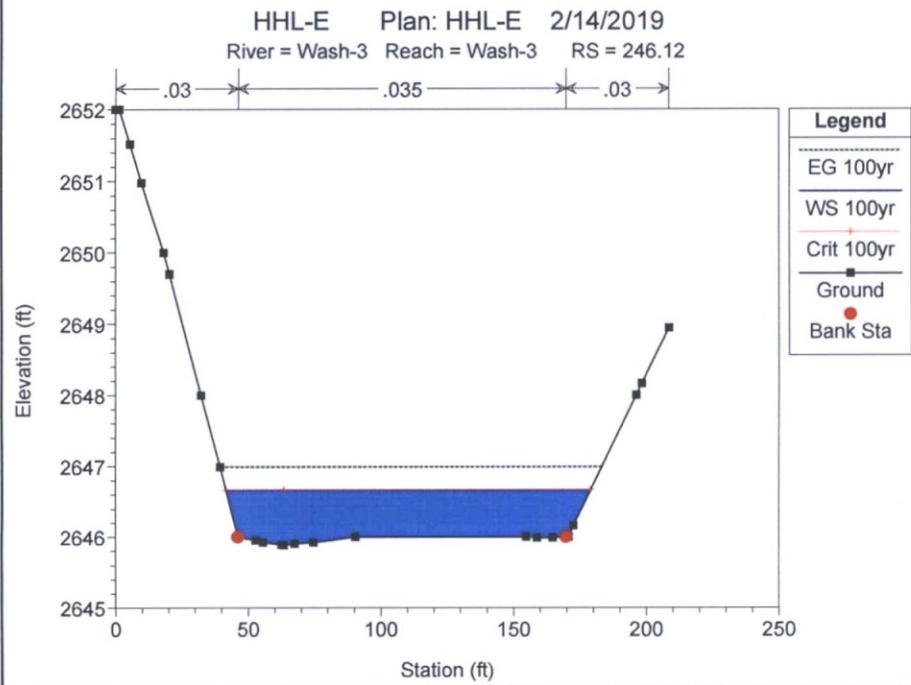
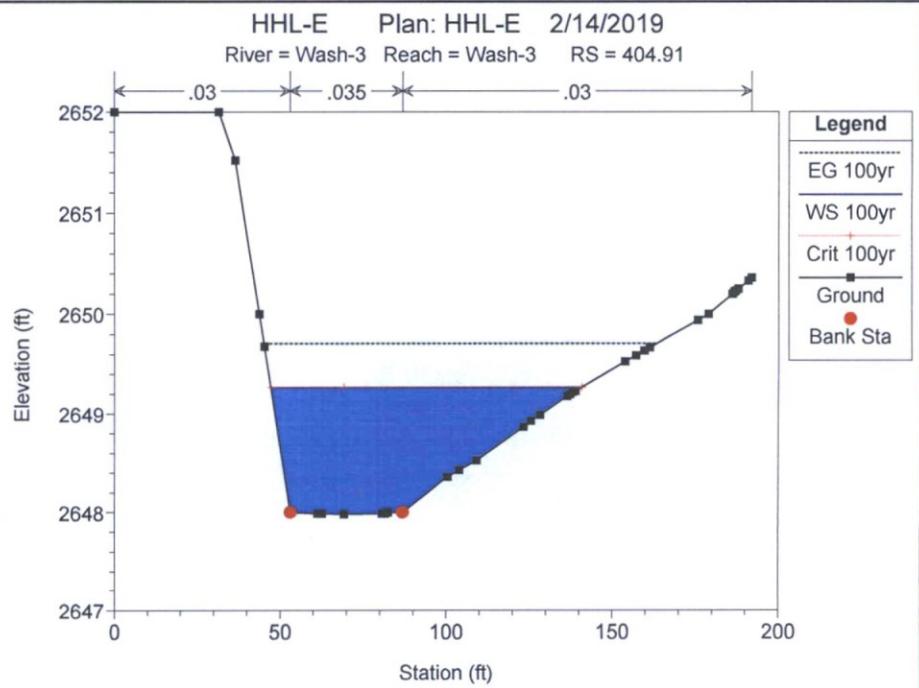
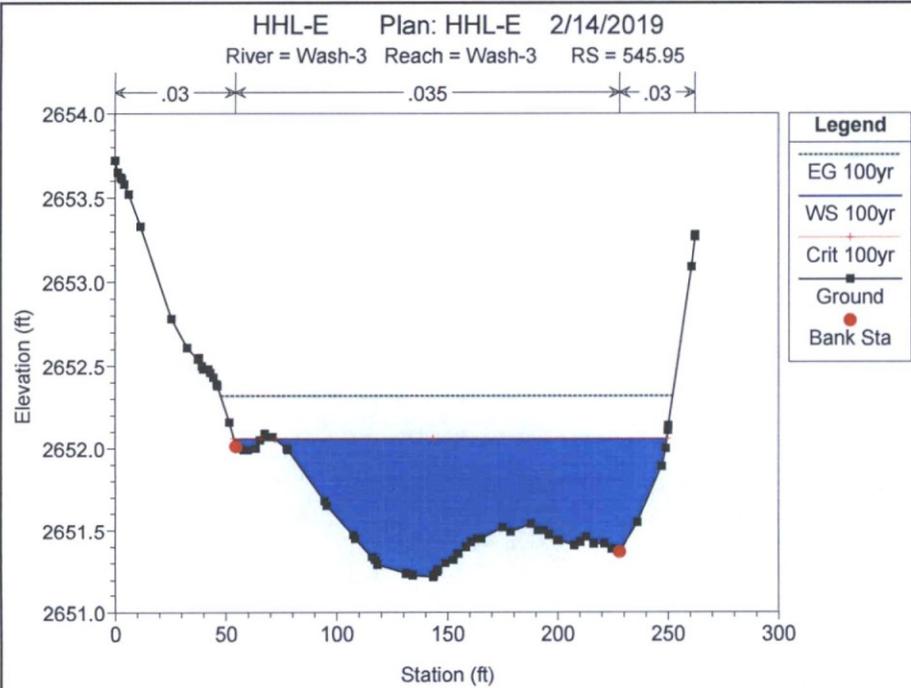


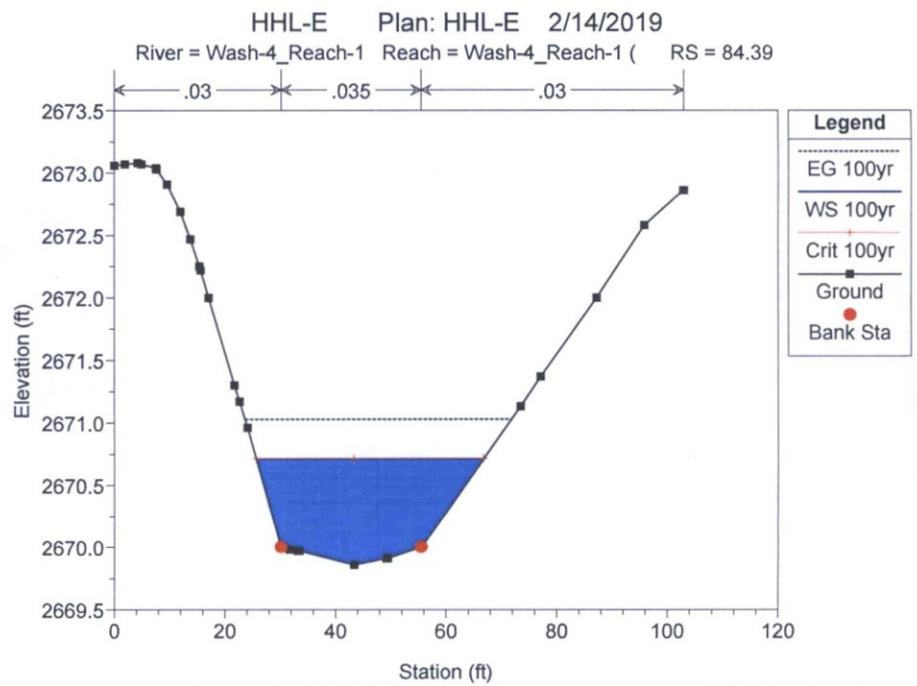
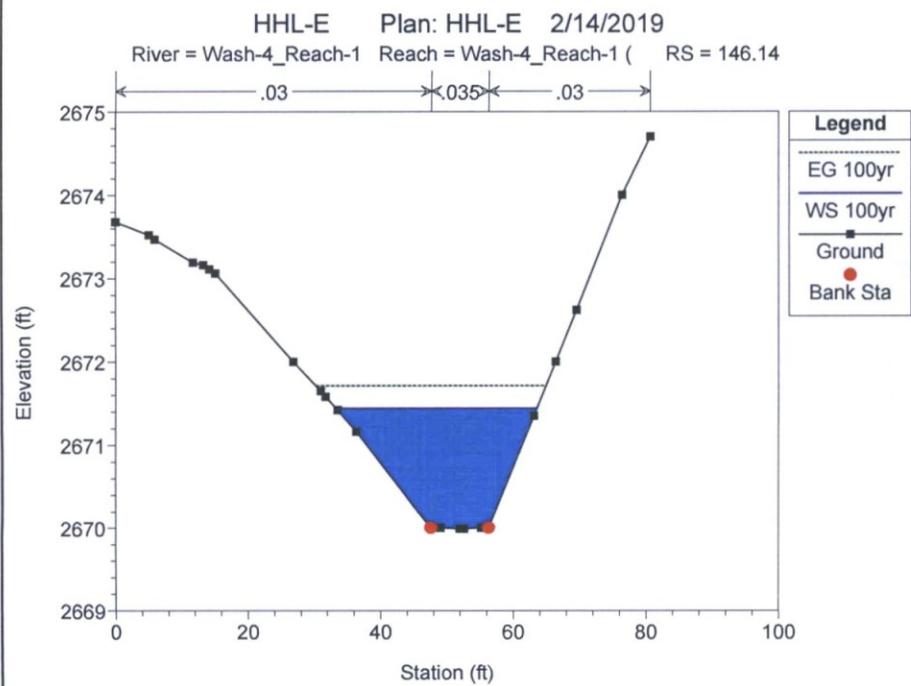
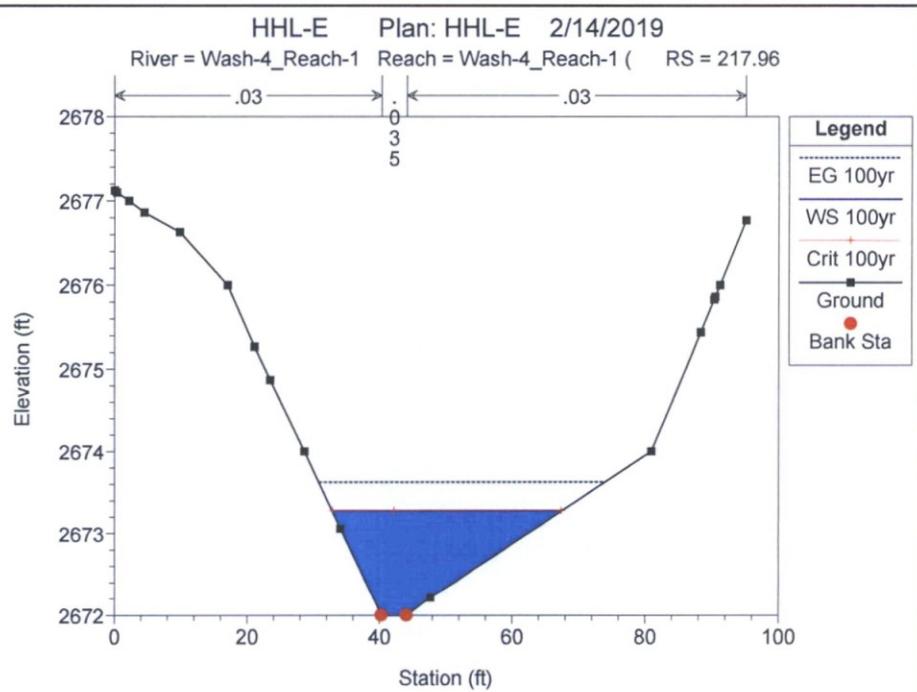
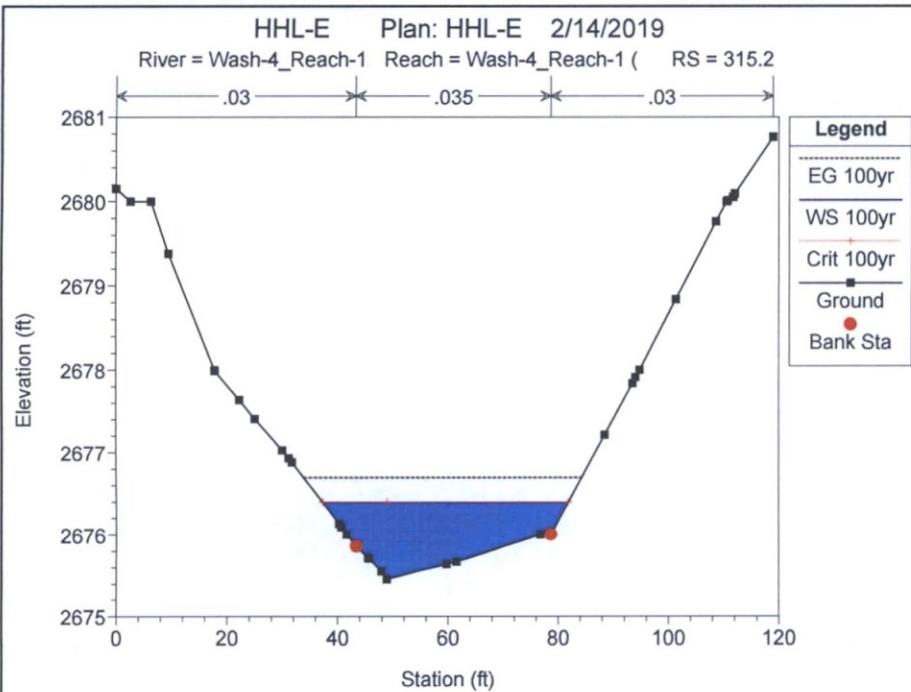


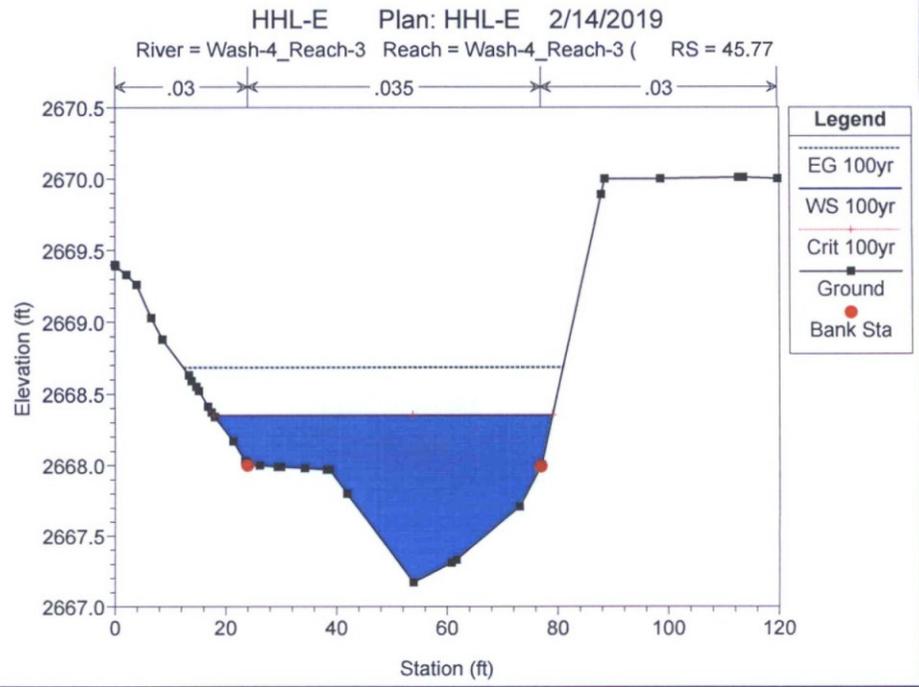
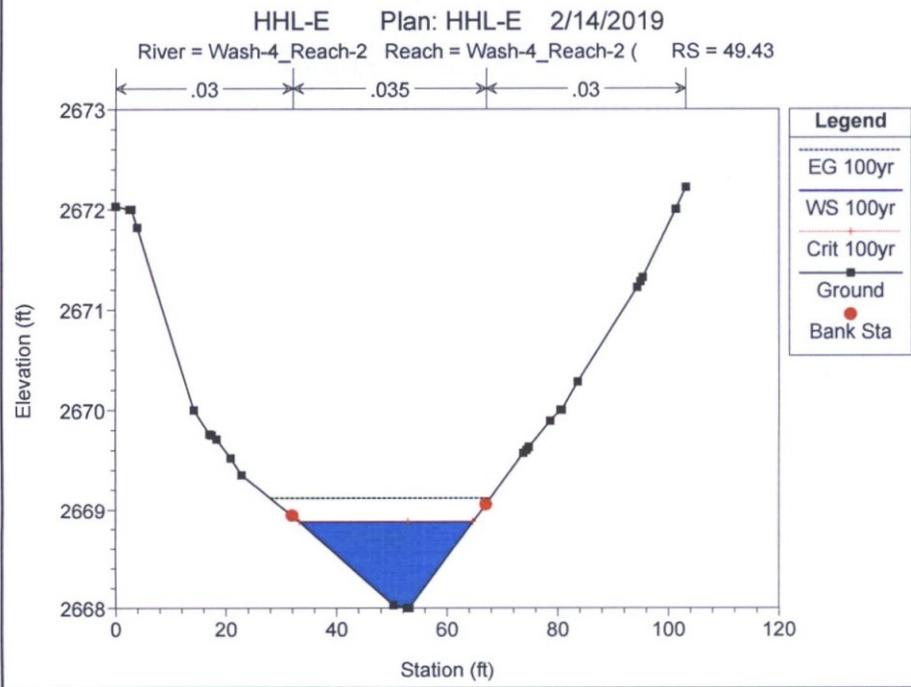
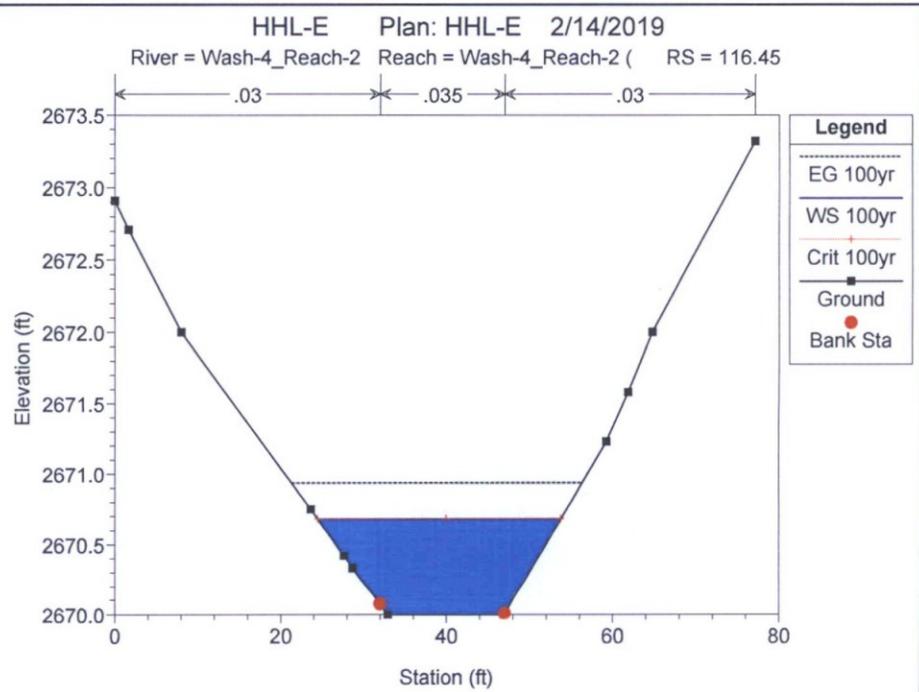
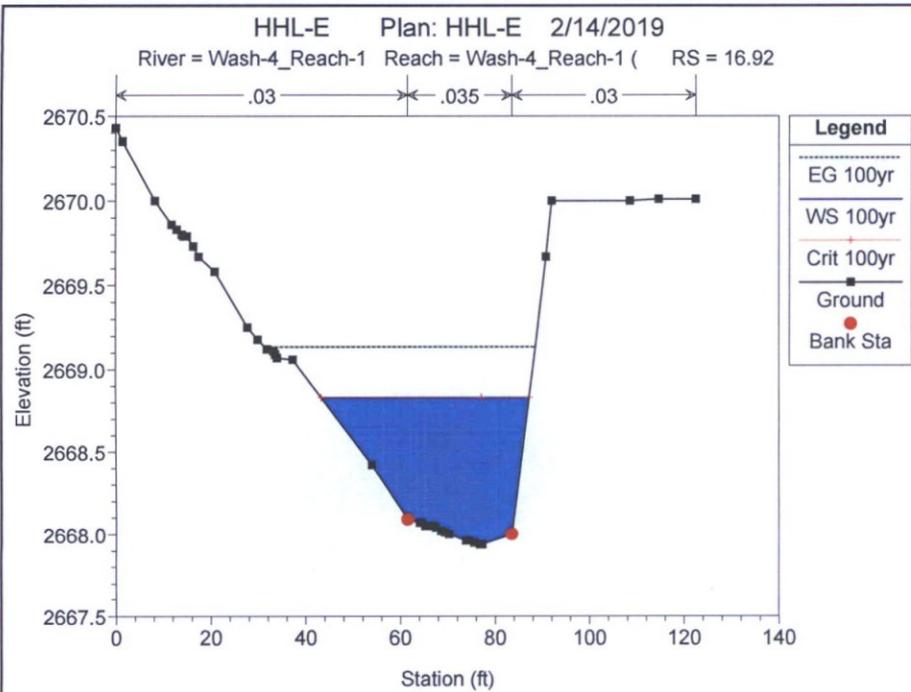






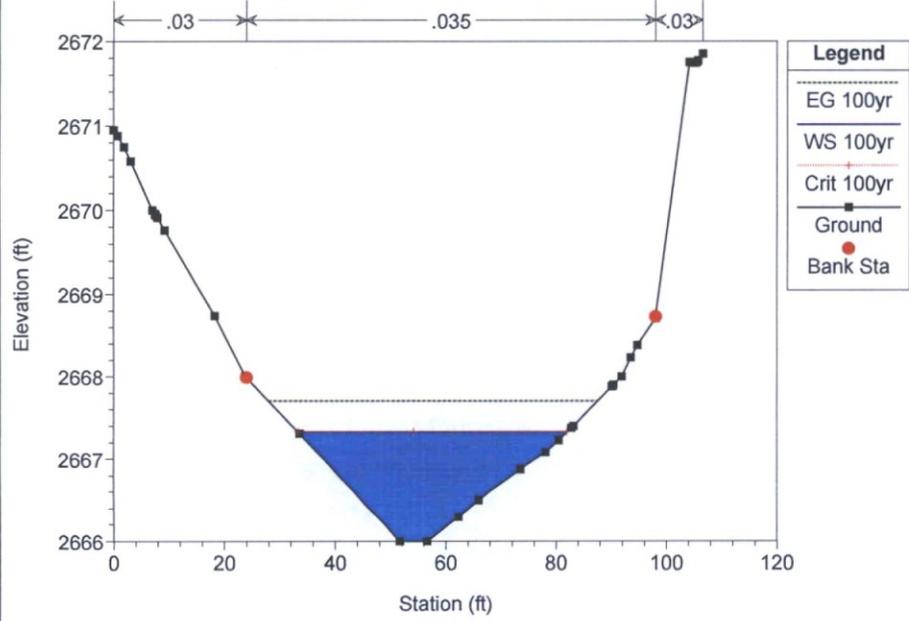






HHL-E Plan: HHL-E 2/14/2019

River = Wash-4_Reach-3 Reach = Wash-4_Reach-3 (RS = 14.68



HHL
Erosion Setback

Location	100-year flow Q100 (ft ³ /s)	Calculated Erosion Setback for straight channels (ft)	Calculated Erosion Setback for Channels with Obvious Curvature (ft)
Wash-1	199	14	35
Wash-2	63	8	20
Wash-3	382	20	49
Wash-4 Reach-1	112	11	26
Wash-4 Reach-2	58	8	19
Wash-4 Reach-3	173	13	33

Reference: State Standard for Watercourse System Sediment Balance SSA 5-96

Setback = $1.0 (Q_{100})^{0.5}$

for straight channels

Setback = $2.5 (Q_{100})^{0.5}$

for channels with obvious curvature

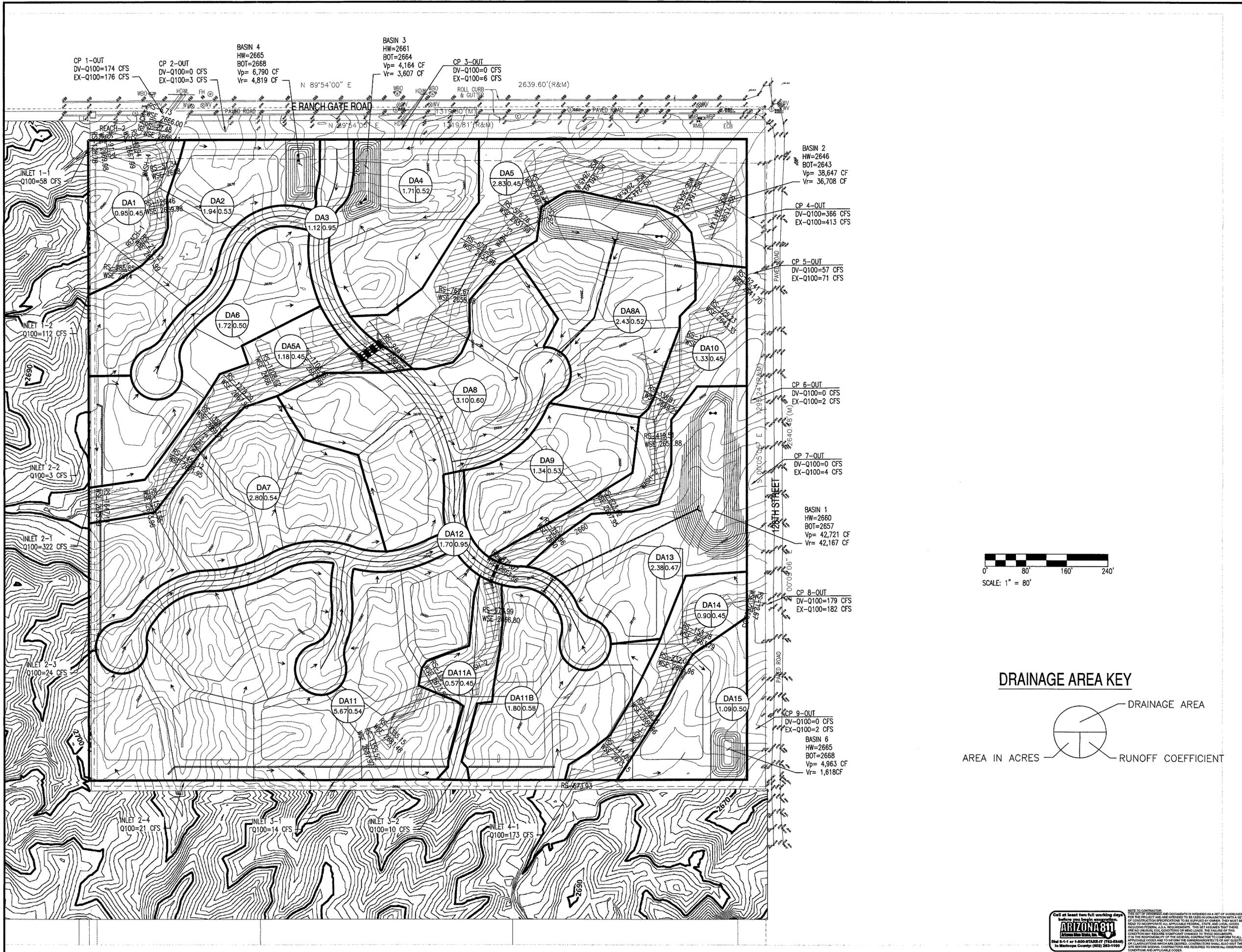


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APPENDIX III

Grading and Drainage Plans

8280 E. Gelding Dr., Suite 101
Scottsdale, AZ 85260



8280 E GELDING DR #101, SCOTTSDALE, ARIZONA 85280
WWW.AZSEG.COM TEL: 480.588.7228

PROJECT: HHL PROPERTY
LOCATION: 128TH STREET AND RANCH GRATE ROAD, SCOTTSDALE, AZ

DATE: 11/30/2018
ISSUED FOR: REZONING

REVISION NO.:	DATE:

JOB NO.: 180424
SHEET TITLE: PROPOSED DRAINAGE AREA MAP

SHEET NO.:

NOTE TO CONTRACTOR:
FOR SET OF DRAWINGS AND DOCUMENTS IS INTENDED AS A SET OF GUIDELINES FOR THE PROJECT AND ARE INTENDED TO BE USED IN CONJUNCTION WITH THE ROAD TO INCORPORATE ALL APPLICABLE FEDERAL, STATE, AND LOCAL CODES INCLUDING LOCAL A.I.A. REQUIREMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL UNUSUAL SOIL CONDITIONS OR WIND LOADS. THE FAILURE OF THIS CONTRACTOR TO VERIFY SUCH CONDITIONS OR WIND LOADS SHALL BE AT HIS OWN RISK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM ALL APPLICABLE AGENCIES AND TO OBTAIN THE CONSENT OF ALL ADJACENT PROPERTY OWNERS AND TO OBTAIN THE CONSENT OF ALL ADJACENT PROPERTY OWNERS. CONTRACTORS ARE REQUIRED TO KNOW ALL OBSERVABLE CONDITIONS AND APPLICABLE CODES.

Call at least two full working days before you begin construction!
ARIZONA 811
811-4-4-4
In Maricopa County (602) 263-1100

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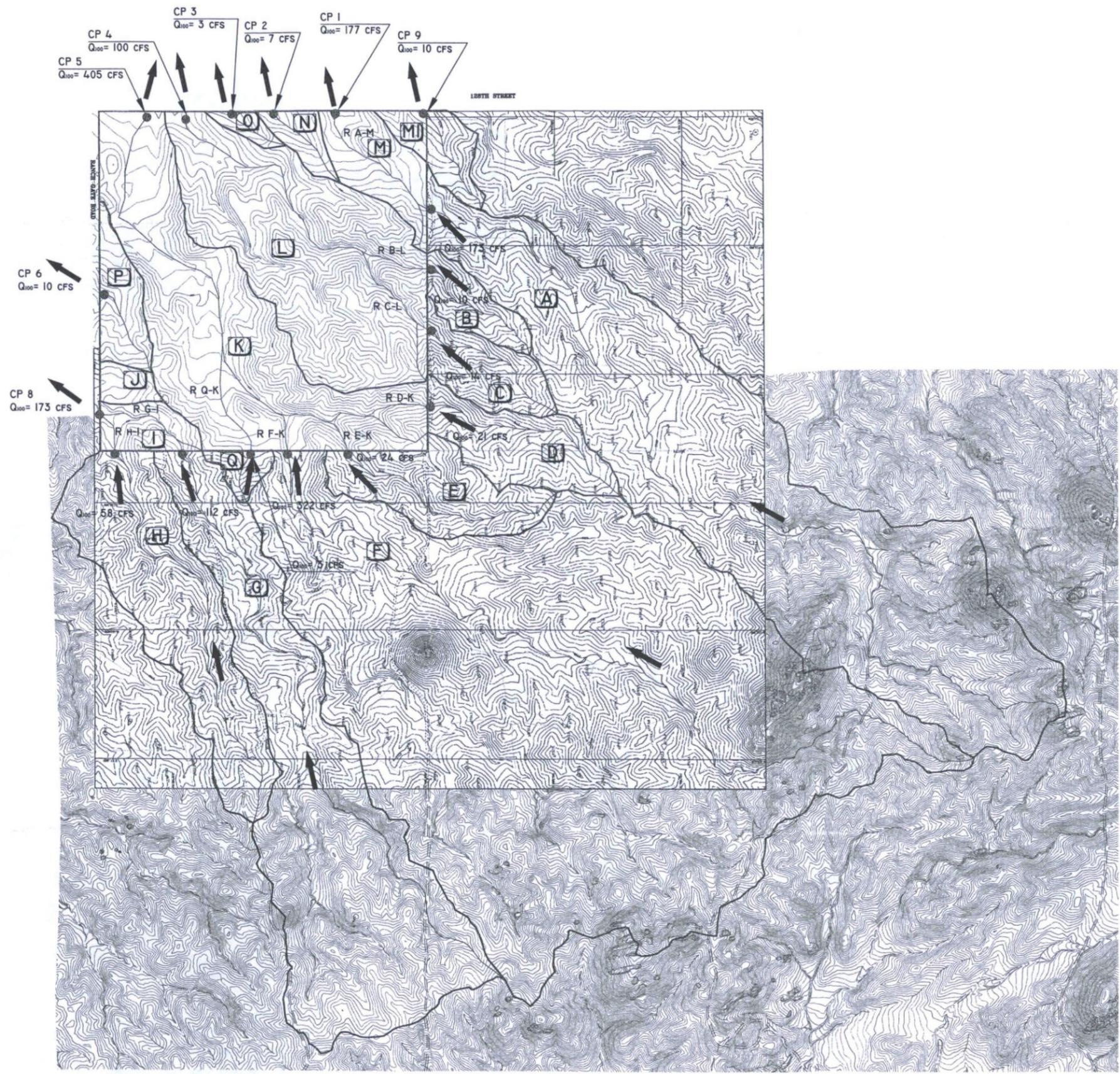
APPENDIX IV

Wood, Patel & Associates, Inc.

Drainage Report Excerpts

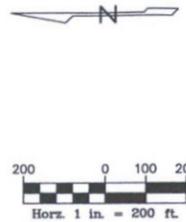
8280 E. Gelding Dr., Suite 101
Scottsdale, AZ 85260

RANCH GATE ROAD & 128TH STREET - 40 ACRES
EXHIBIT 7
EXISTING CONDITIONS SUB BASIN MAP



LEGEND

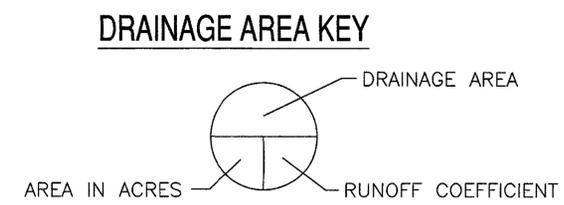
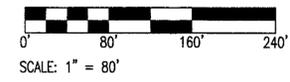
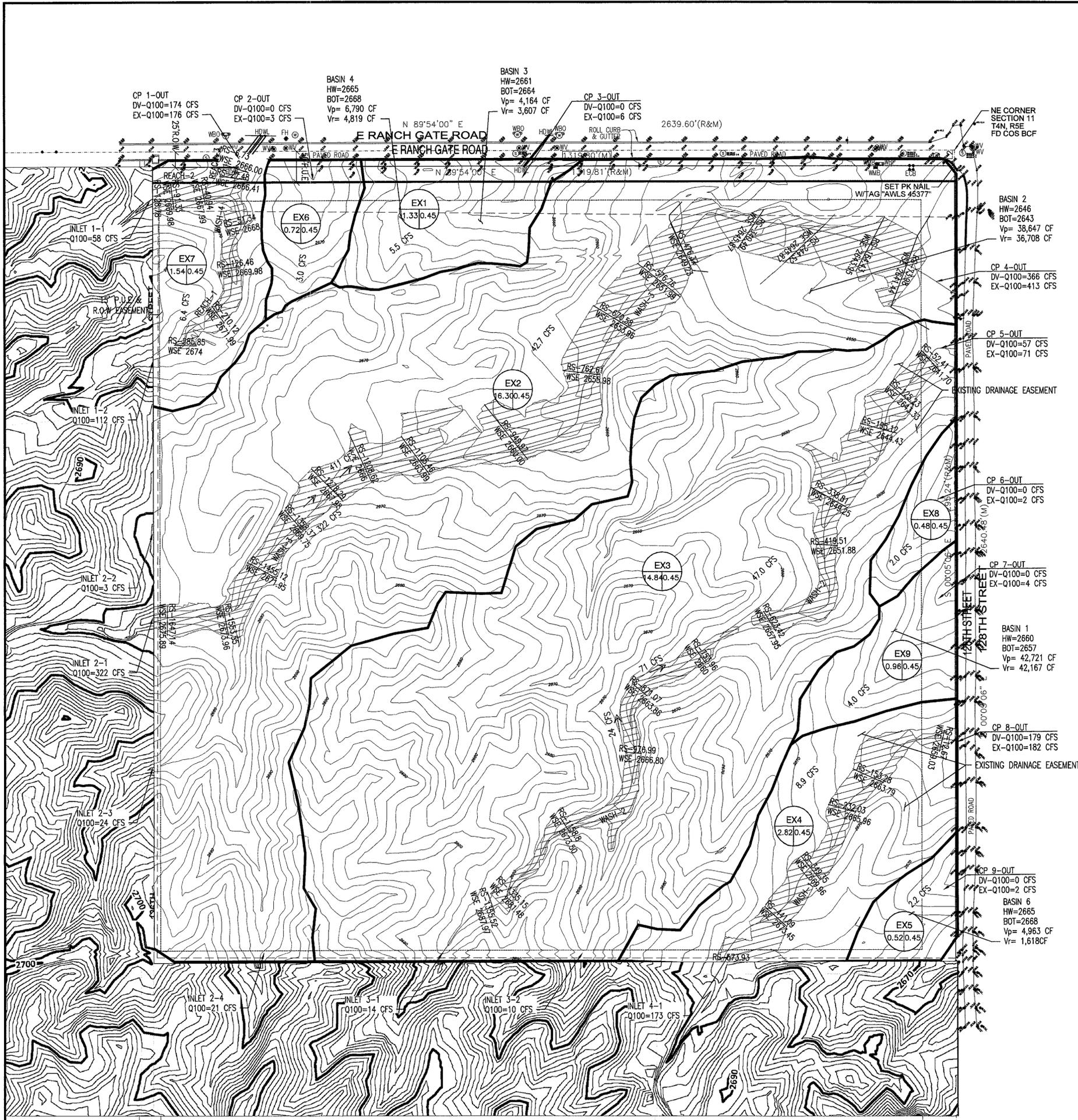
- PROJECT BOUNDARY
- CONCENTRATION POINT
- SUB BASIN ID
- EXISTING CONDITION 100-YEAR PEAK FLOW
- DIRECTION OF FLOW
- ROUTING REACH
- TIME OF CONCENTRATION REACH
- SUB BASIN BOUNDARY



**PRELIMINARY
NOT
FOR CONSTRUCTION
OR RECORDING**

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CONSTRUCTION MANAGEMENT
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Phoenix, AZ 85021
(602) 335-8500
www.woodpatel.com
PHOENIX • MESA • TUCSON
ENGINEER G. BROWNELL
DESIGNER R. McFADDEN
CAD TECHNICIAN STAFF
SCALE (HORIZ) 1" = 200'
SCALE (VERT) N/A
DATE 01/09/2009
JOB NUMBER 073142
SHEET 1 OF 1

N:\2007\073142\Project_Support\Hydro-Exhibits\EXHIBIT 07-Existing Cond. Sub Basin MAP.dwg - Jan 09, 2009



BASIN 4
 HW=2665
 BOT=2668
 Vp= 6,790 CF
 Vr= 4,819 CF

BASIN 3
 HW=2661
 BOT=2664
 Vp= 4,164 CF
 Vr= 3,607 CF

BASIN 2
 HW=2646
 BOT=2643
 Vp= 38,647 CF
 Vr= 36,708 CF

BASIN 1
 HW=2660
 BOT=2657
 Vp= 42,721 CF
 Vr= 42,167 CF

BASIN 6
 HW=2665
 BOT=2668
 Vp= 4,963 CF
 Vr= 1,618CF

CP 1-OUT
 DV-Q100=174 CFS
 EX-Q100=176 CFS

CP 2-OUT
 DV-Q100=0 CFS
 EX-Q100=3 CFS

CP 3-OUT
 DV-Q100=0 CFS
 EX-Q100=6 CFS

CP 4-OUT
 DV-Q100=366 CFS
 EX-Q100=413 CFS

CP 5-OUT
 DV-Q100=57 CFS
 EX-Q100=71 CFS

CP 6-OUT
 DV-Q100=0 CFS
 EX-Q100=2 CFS

CP 7-OUT
 DV-Q100=0 CFS
 EX-Q100=4 CFS

CP 8-OUT
 DV-Q100=179 CFS
 EX-Q100=182 CFS

CP 9-OUT
 DV-Q100=0 CFS
 EX-Q100=2 CFS

INLET 1-1
 Q100=58 CFS

INLET 1-2
 Q100=112 CFS

INLET 2-1
 Q100=322 CFS

INLET 2-2
 Q100=3 CFS

INLET 2-3
 Q100=24 CFS

INLET 2-4
 Q100=21 CFS

INLET 3-1
 Q100=14 CFS

INLET 3-2
 Q100=10 CFS

INLET 4-1
 Q100=173 CFS

NE CORNER SECTION 11
 T4N, R5E
 FD COS BCF

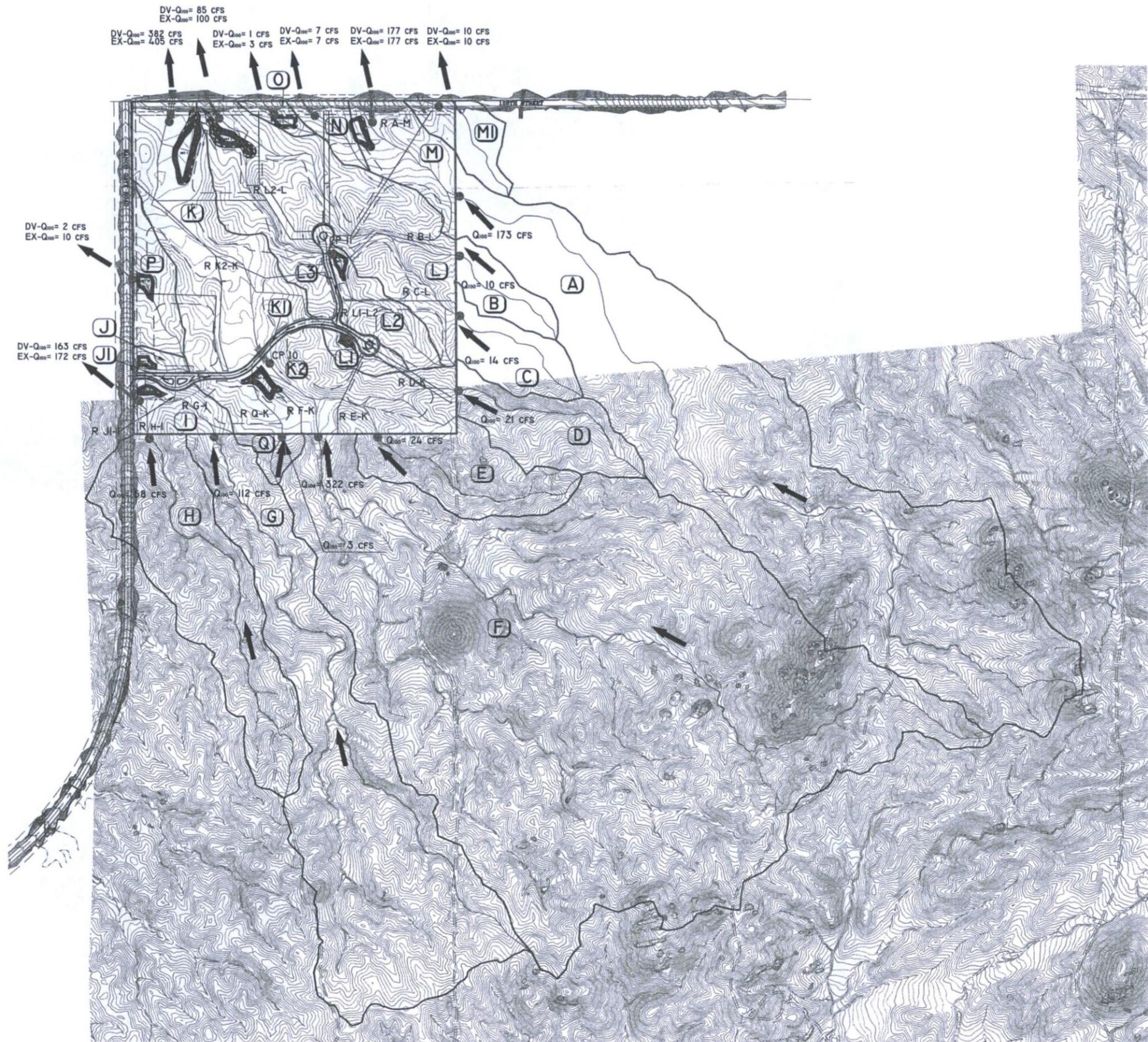


8280 E GELDING DR #101, SCOTTSDALE, ARIZONA 85280
 WWW.AZSEG.COM TEL: 480.588.7226

PROJECT	HIL PROPERTY	LOCATION	128TH STREET AND RANCH GRATE ROAD, SCOTTSDALE, AZ
DRAWN	LI	CHECKED	ALI
PROJ. MGR.	GULINO	DATE:	11/30/2018
ISSUED FOR:	REZONING	REVISION NO.:	DATE:
JOB NO.:	180424	SHEET TITLE:	EXISTING DRAINAGE AREA MAP
SHEET NO.:			



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RANCH GATE ROAD & 128TH STREET - 40 ACRES
EXHIBIT 8
DEVELOPED CONDITIONS SUB BASIN MAP

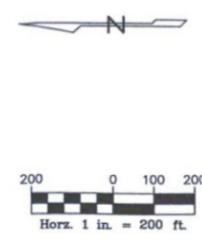
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ENGINEER G. BROWNELL
DESIGNER R. McFADDEN
CAD TECHNICIAN STAFF
SCALE (HORIZ) 1" = 200'
SCALE (VERT) N/A
DATE 01/09/2009
JOB NUMBER 073142
SHEET 1 OF 1

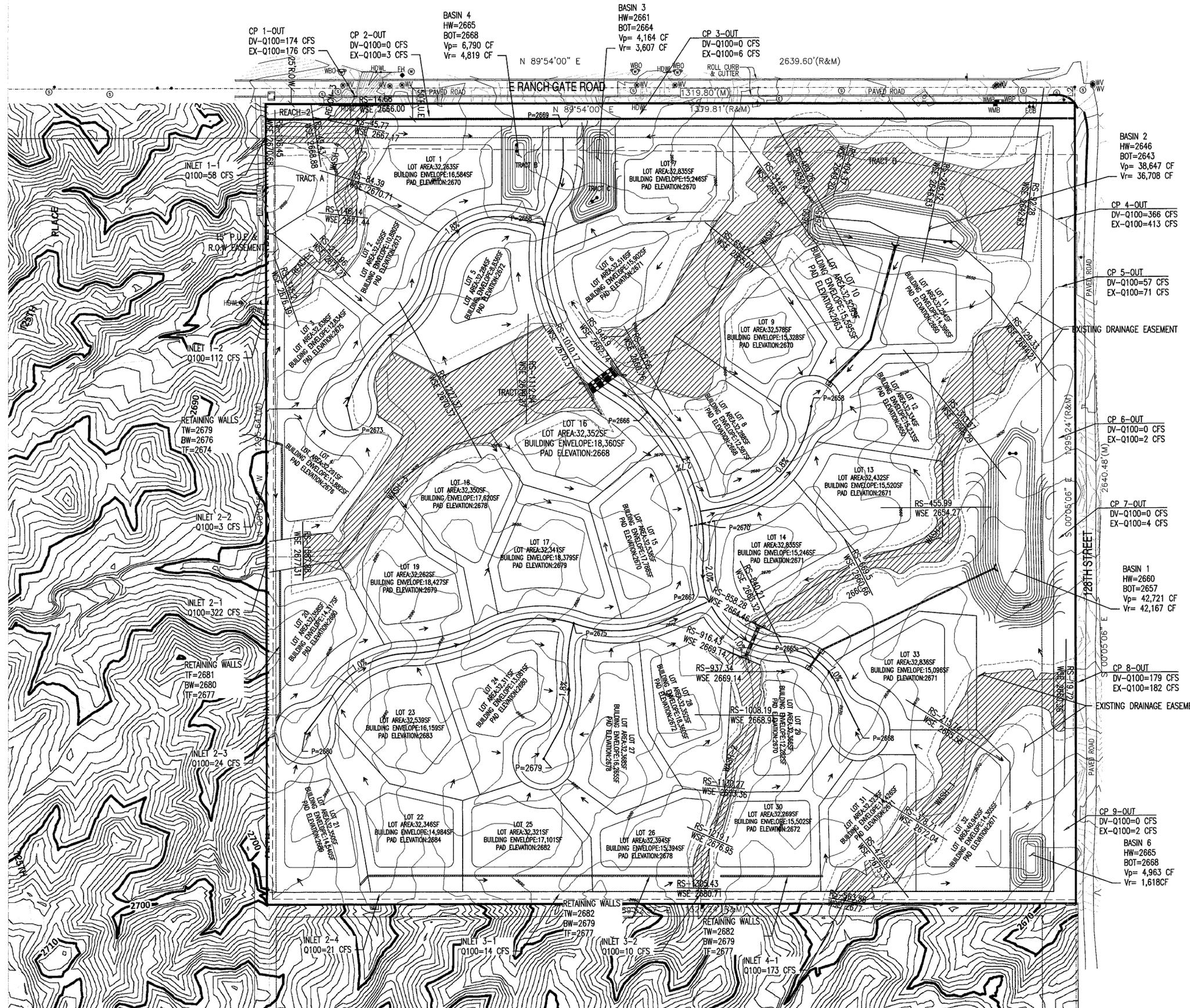
LEGEND

- PROJECT BOUNDARY
- CP 6 CONCENTRATION POINT
- SUB BASIN ID
- DEVELOPED CONDITION 100-YEAR PEAK FLOW
- DIRECTION OF FLOW
- R B-BI ROUTING REACH
- TIME OF CONCENTRATION REACH
- SUB BASIN BOUNDARY



N:\2007\0713142\Project_Support\Hydro\Exhibits\EXHIBIT 08-Developed Cond. Sub Basin Map.dwg - Jan 09, 2009

PRELIMINARY GRADING AND DRAINAGE PLAN



BASIN 2
HW=2646
BOT=2643
Vp= 38,647 CF
Vr= 36,708 CF

CP 4-OUT
DV-Q100=366 CFS
EX-Q100=413 CFS

CP 5-OUT
DV-Q100=57 CFS
EX-Q100=71 CFS

CP 6-OUT
DV-Q100=0 CFS
EX-Q100=2 CFS

CP 7-OUT
DV-Q100=0 CFS
EX-Q100=4 CFS

BASIN 1
HW=2660
BOT=2657
Vp= 42,721 CF
Vr= 42,167 CF

CP 8-OUT
DV-Q100=179 CFS
EX-Q100=182 CFS

CP 9-OUT
DV-Q100=0 CFS
EX-Q100=2 CFS

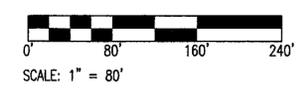
BASIN 6
HW=2668
BOT=2668
Vp= 4,963 CF
Vr= 1,618 CF

RETENTION VOLUME REQUIREMENTS:

REQUIRED VOLUME: 57,894 CF
PROVIDED VOLUME: 81,482 CF

LEGEND:

- EASEMENT LINE
- PROPERTY LINE
- LIMITS OF INUNDATION
- STORM DRAIN CB
- STORM DRAIN PIPE
- RIDGE LINE
- RETAINING WALL
- EROSION SETBACK
- 1' CONTOURS
- WASH CENTER LINE



8280 E GELDING DR #101, SCOTTSDALE, ARIZONA 85260
WWW.AZSEG.COM TEL: 480.988.7228

PROJECT	HHL PROPERTY	LOCATION	128TH STREET AND RANCH GRATE ROAD, SCOTTSDALE, AZ
DRAWN	LI	DATE:	02/15/2019
DESIGNED	LI	ISSUED FOR:	REZONING
CHECKED	ALI	REVISION NO.:	
PROJ. MGR.	GULINO	DATE:	
JOB NO.:	180424	SHEET TITLE:	PRELIMINARY GRADING AND DRAINAGE PLAN
SHEET NO.:			



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PELIMINARY MASTER/BASIS OF DESIGN REPORT

WATER & SEWER for the Zoning Case

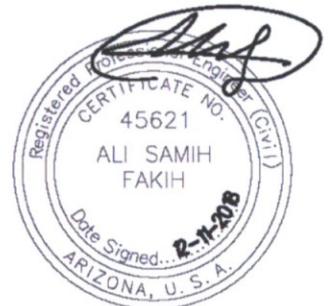
McDowell Mountain Manor (Ranch Gate & 128th Street)

Southwest corner of 128th Street and Ranch Gate Road
Scottsdale, Arizona

Prepared For:

HHL Land, LLC

Prepared by:



EXPIRES 12-31-19

Sustainability Engineering Group

8280 E. Gelding Drive, Suite 101
Scottsdale, AZ 85260
480.588.7226 www.azSEG.com

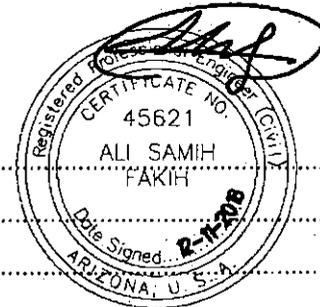
Project Number: 180424

Submittal Date: August 3, 2018
2nd Submittal: December 13, 2018

Zoning Case No.: 18-ZN-20148

Plan Check No.: TBD

18-ZN-2018
12/13/2018

Table of Contents


1. EXECUTIVE SUMMARY.....	1
2. INTRODUCTION.....	1
2.1 PLAN OBJECTIVE:.....	1
2.2 SITE LOCATION.....	1
2.3 PROPOSED DEVELOPMENT.....	1
3. DESIGN CRITERIA.....	2
3.1 DEVELOPMENT CRITERIA.....	2
4. DEMANDS.....	2
4.1 EXISTING AND PROPOSED DEMANDS.....	2
4.2 WATER ZONE.....	3
4.3 PHASING OF PROJECT.....	3
4.4 SUMMARY NARRATIVE OF DEMANDS.....	3
5. EXISTING INFRASTRUCTURE / CONDITIONS.....	3
5.1 ADJACENT PIPE LINES.....	3
5.2 ADJACENT DEVELOPMENTS.....	3
6. PROPOSED INFRASTRUCTURE.....	3
6.1 WATER DISTRIBUTION SYSTEM.....	3
6.2 SEWER COLLECTION SYSTEM.....	4
6.3 MAINTENANCE AND OWNERSHIP.....	4
7. WATER COMPUTATIONS.....	4
7.1 DESCRIPTION OF MODEL.....	4
8. SEWER COMPUTATIONS.....	4
8.1 DESCRIPTION.....	4
9. SUMMARY / CONCLUSIONS.....	4
10. REFERENCES.....	5
11. EXHIBITS.....	5

1. EXECUTIVE SUMMARY

The proposed development consists of 40 acres of undisturbed desert land located south and west of 128th Street and Ranch Gate Road in Scottsdale Arizona. The property is presently zoned R1-130 ESL and is requesting a change to R1-43 ESL for the development of thirty-three (33) single-family residential lots. A preliminary plat, case number 11-PP-2008#2, consisting of thirteen (13) single family lots was approved in 2013.

Public right-of-way exists along Ranch Gate Road and a roadway easement along 128th Street. An existing twenty (20) foot wide public utility and roadway easement exists along the project's south property line (Juan Tabo Lane alignment) providing access to adjacent parcels.

City of Scottsdale is the water and sewer service provider for this property and all water and sewer improvements will be designed and constructed to City's standards. Public onsite water extensions will be looped through the development from Ranch Gate to Juan Tabo and east to 128th Street. Extension of the 128th Street water line south from Ranch Gate across the site's frontage will be either constructed by this development or others as needed.

Sewer service will connect to an 8" sewer along the project's frontage to Ranch Gate and additional connections to a sewer in 128th Street as topography dictates. Likewise, extension of the 128th Street sewer line south from Ranch Gate across the site's frontage will be either constructed by this development or others as needed.

City staff has stated water and sewer facility payback agreements (Reference No. 4) exist for infrastructure located adjacent to this property and the related facilities. Terms of those agreements need to be satisfied per the respective provisions of those agreements. Refer to Section 9.

2. INTRODUCTION

2.1 PLAN OBJECTIVE:

The purpose of this report is a) show demands representing the existing and proposed zoning impact, b) show the proposed maximum water and sewer demands and c) present sufficient water and sewer investigation to support the rezoning request.

2.2 SITE LOCATION

The subject property consists of one parcel with the following County Parcel ID number:

- 217-01-025A

See EXHIBIT 1 - Vicinity Map – Context Aerial for the project's location with respect to major cross streets.

2.3 PROPOSED DEVELOPMENT

2.3.1 Existing Site Description:

This site is vacant desert land generally sloping from the west to the east (elevation 2700 +/- to 2640 +/-) at approximately 4%. Refer to **EXHIBIT 2 – Aerial** for an overall view.

2.3.2 Proposed Site Development:

The current plan for the property proposes thirty-three (33) single-family residential units potentially featuring private streets and a gated entry. All necessary tracts and easements for the installation of utilities will be provided as part of the final plat.

3. DESIGN CRITERIA

3.1 DEVELOPMENT CRITERIA

Existing zoning: R1-130 ESL
 Proposed zoning: R1-43ESL
 Acreage: 40

Demands, system layout, system pressures, velocities, head losses and fire flow will be all be in accordance with the City's DS&PM, 2017 revision.

Fire flow demands utilized in the final hydraulic calculations will be in accordance with requirements of the 2015 International Fire Code. A 1000 gpm system fire flow demand is anticipated per Appendix B of the Fire Code based on the floor area of wood frame homes being less than 6200 sq. ft.

4. DEMANDS

4.1 EXISTING AND PROPOSED DEMANDS

Refer to the tables below for the existing and proposed water and sewer demand calculations based on the design criteria in the City's DS+PM:

EXISTING ZONING

Table 3: WATER DEMAND CALCULATIONS

	Units	Avg. Day Demand (GPM)	Max. Day Peaking Factor	Peak Hour Peaking Factor	Avg. Day Demand (GPM)	Max. Day Demand (GPM)	Peak Hour (GPM)
R1-130	13	0.69	2	3.5	9	18	31

Table 4 - SEWER DEMAND CALCULATIONS

	Units	Avg. Day Demand (gal/person)	Persons per Unit	Avg. Day Demand (GPD)	Peaking Factor	Peak Flow (GPM)
R1-130	13	100	2.5	3,250	4	9

PROPOSED ZONING
Table 1: WATER DEMAND CALCULATIONS

	Units	Avg. Day Demand (GPM)	Max Day Peaking Factor	Peak Hour Peaking Factor	Avg. Day Demand (GPM)	Max. Day Demand (GPM)	Peak Hour (GPM)
R1-43	33	0.69	2	3.5	23	46	80

Table 2 - SEWER DEMAND CALCULATIONS

	Units	Avg. Day Demand (gal/person)	Persons per Unit	Avg. Day Demand (GPD)	Peaking Factor	Peak Flow (GPM)
R1-43	33	100	2.5	8,250	4	23

4.2 WATER ZONE

The property will be developed entirely within pressure Zone 12.

4.3 PHASING OF PROJECT

The project is proposed to be constructed in a single phase.

4.4 SUMMARY NARRATIVE OF DEMANDS

The max day + fire flow scenario of 546 gpm will likely govern the water system design. Onsite sewer flows may increase slightly in the future by development of the two parcels south of Juan Tabo Lane. This increase will be minimal with respect to the existing topography and more than sufficient capacity exists in the proposed 8-inch system.

5. EXISTING INFRASTRUCTURE / CONDITIONS
5.1 ADJACENT PIPE LINES

City of Scottsdale Water & Sewer Quarter Section Maps (47-57 and 47-58) show a 12" water line available in Ranch Gate along with an 8" sewer. No water or sewer lines are currently constructed along the property's 128th Street frontage. Refer to **EXHIBIT 4** for the COS Water and Sewer Quarter Section Maps (47-57 and 47-58).

5.2 ADJACENT DEVELOPMENTS

Sereno Canyon abuts the west side of this site and three undeveloped parcels abut the south line. Ranch Gate Road and State Land lie to the north and 128th Street and two undeveloped parcels lie to the east. Story Rock, a master planned community, also lies east of 128th Street encompassing most of the available private land.

6. PROPOSED INFRASTRUCTURE
6.1 WATER DISTRIBUTION SYSTEM

This development will connect to the 12" water line in Ranch Gate Road, extend through the interior street system, connecting to a proposed 8" line in the Juan Tabo alignment and reconnect

to the 128th Street water line at the south east corner of the site providing redundant domestic water and fire service. A 12" water line along the site's 128th Street frontage will be constructed by either this project or others as construction timing dictates. Refer to **EXHIBIT 3** for the Conceptual Site Plan.

6.2 SEWER COLLECTION SYSTEM

Site topography will likely require a connection to the existing 8" sewer line in Ranch Gate Road at the main entrance and two connections to an 8" sewer line in 128th Street from the two cul-de-sacs. Likewise, the 8" sewer line along the site's 128th Street frontage will be constructed by either this project or others as construction timing dictates. A sewer line will be extended off a southern cul-de-sac providing service to two of the three undeveloped parcels at the Juan Tabo alignment. The third undeveloped parcel will have service available off 128th Street. Refer to **EXHIBIT 3** for the Conceptual Site Plan.

6.3 MAINTENANCE AND OWNERSHIP

All water and sewer lines are proposed as public lines located within rights-of-ways or easements/tracts and will be owned and maintained by the city.

7. WATER COMPUTATIONS

7.1 DESCRIPTION OF MODEL

The proposed water system will be designed to meet the criteria of COS Water, the Arizona Department of Environmental Quality ("ADEQ"), and Maricopa County Environmental Services Department ("MCESD").

Bentley WaterCAD® Version 8i will be used to model the water distribution system for the Final Water Basis of Design Report.

8. SEWER COMPUTATIONS

8.1 DESCRIPTION

Sewer flows will be evaluated using Manning's equation and the parameters within the DS+PM in the Final Sewer Basis of Design Report. Excel spreadsheets will tabulate the pipe hydraulics including invert info, pipe diameter, n, slope, peak flow, flow depth, d/D and flow at 0.65 d/D.

9. SUMMARY / CONCLUSIONS

- The Water Facility Payback Agreement indicates sufficient water supply is available to support domestic and fire flow demand of this project. Payment for 33 EDU's of water service is required prior to approval of the final plat. Offsite improvements will include the extension of a 12" water line along the 128th Street frontage. A fire hydrant flow test will be scheduled to support hydraulic calculations with the final design report.
- Sufficient sewer service is presently available at this time as capacity of the sewer lift station located north of Ranch Gate at 128th Street is not fully reserved through provisions of that

facility's payback agreement. The agreement indicates sewer capacity within the regional lift station is based on a first-come first-serve basis and reserved upon payment (reservation) for the EDU's of sewer service. Reservation of available EDUs is required prior to the approval of the final plat.

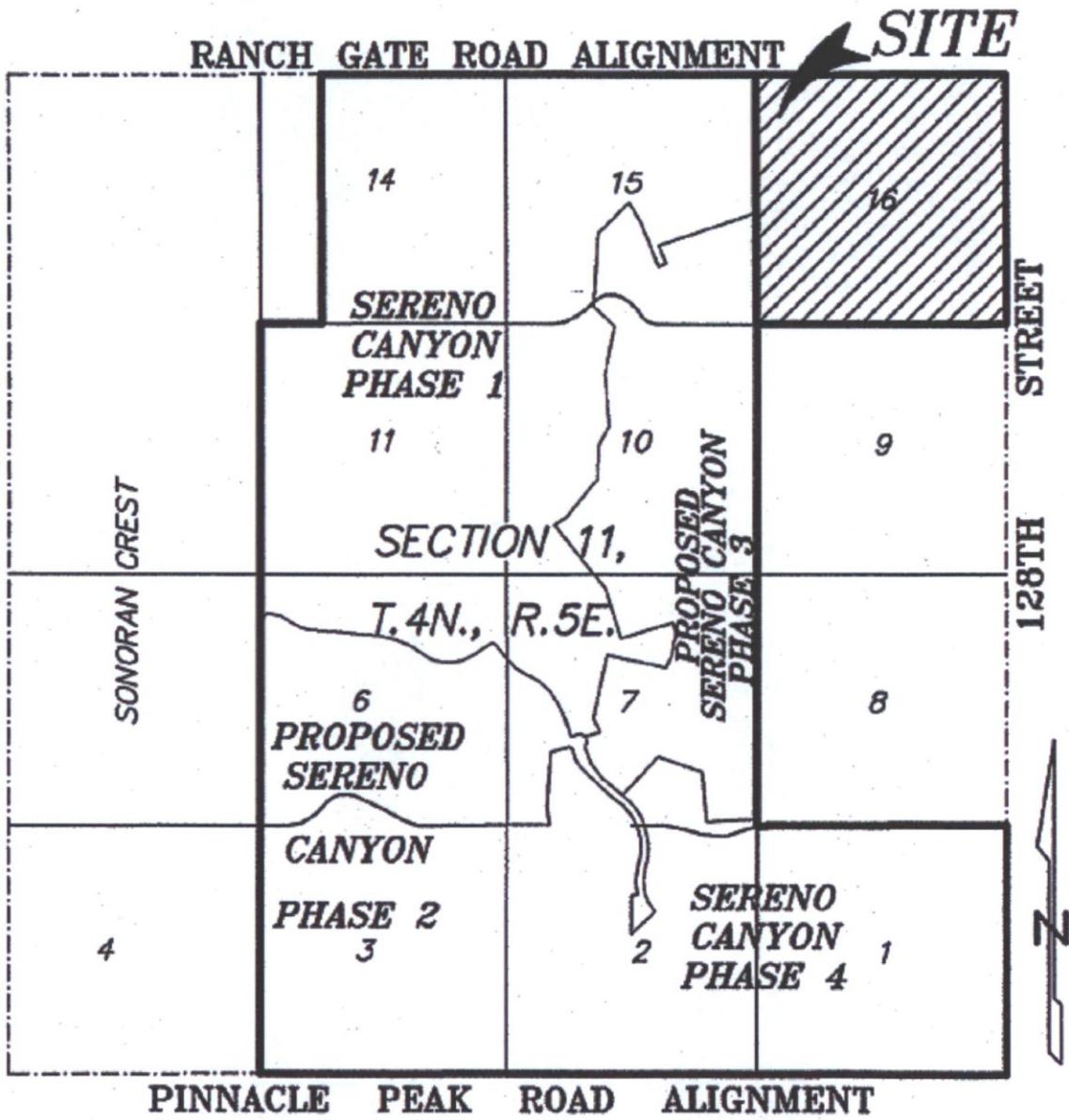
- Per the Facilities Payback Agreements, the developer may request a partial reimbursement of fees paid for the 33 EDU's of water and sewer service through a credit agreement with the City after payment of the appropriate development fees associated with the meter size. The respective reimbursement of a development fee cannot exceed the fee amount and is paid quarterly as meters are set.

10. REFERENCES

1. COS QS numbers 46-58.
2. City of Scottsdale Design Standards & Policies Manual, 2017 - Chapter 6 – Water.
3. City of Scottsdale Design Standards & Policies Manual, 2017 - Chapter 7 – Wastewater.
4. Reimbursement/payback agreements:
 - Ranch Gate Road street payback agreement (1-TP-2016)
 - Water and sewer facilities payback agreements:
 - Facilities Payback Agreement – Water System, 1st Amendment (2010-168-COS-A1)
 - Facilities Payback Agreement – Sewer System, 1st Amendment (2010-169-COS-A1)

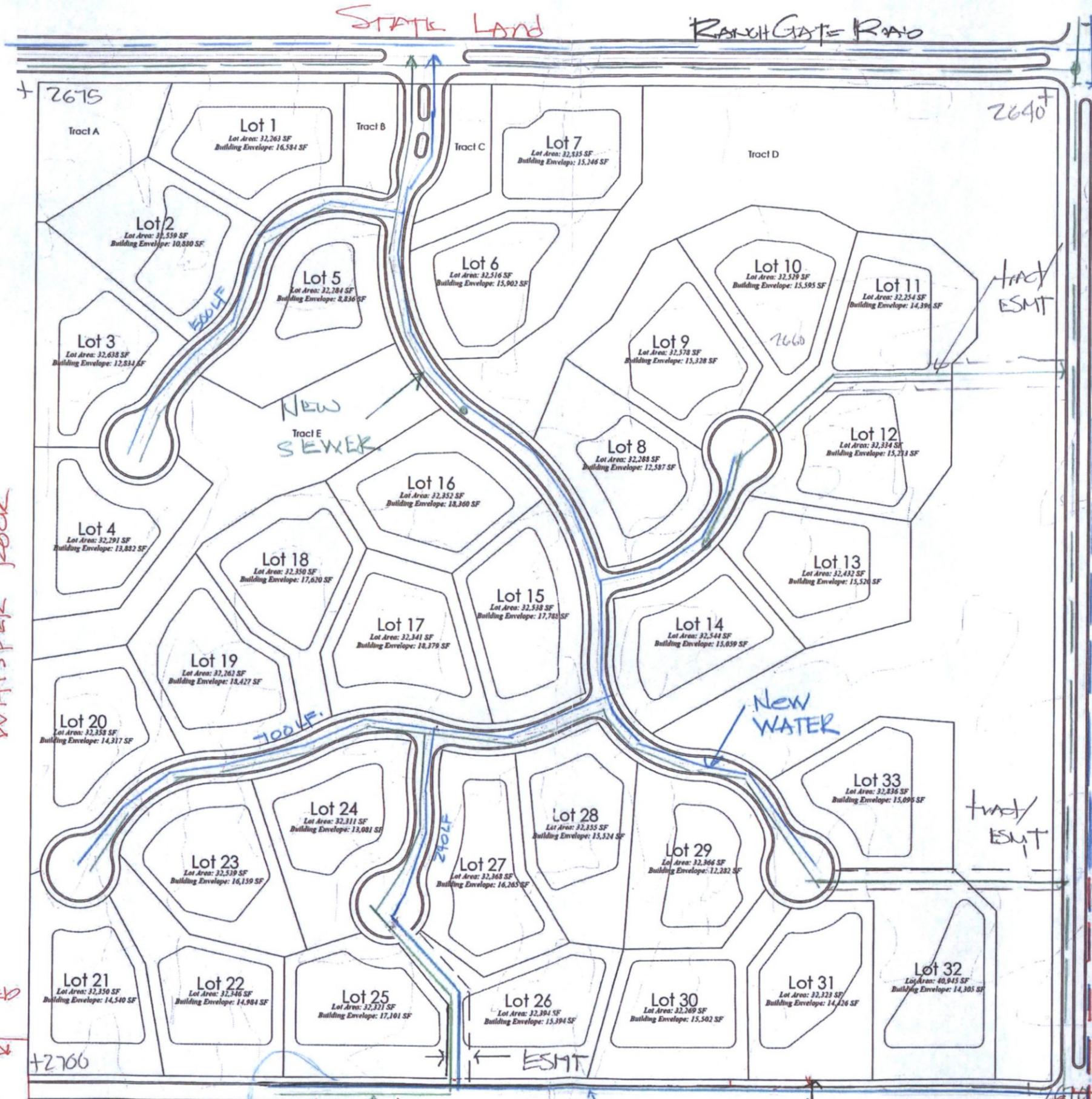
11. EXHIBITS:

- EXHIBIT 1 - Vicinity Map
- EXHIBIT 2 - Aerial
- EXHIBIT 3 - Site Plan
- EXHIBIT 4 - Q-S Map 46-58 (water, sewer, topo)



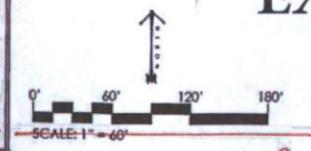
VICINITY MAP
N.T.S.

EXHIBIT 1



Ranch Gate - Conceptual Site Plan
WEXLER

EXHIBIT 3



Prepared by: Greer Pickett
May 31, 2018

WISPER ROCK

20' DEDICATED

NEW SEWER
GILLING WATER

NEW WATER

20' DEDICATED
GEM IDLV.

STATE LAND

RANCH GATE ROAD

Storm Drain

15' x 4' L&V

15' x 4' L&V

128 TH STREET

Tract ESMT

Tract ESMT

ESMT

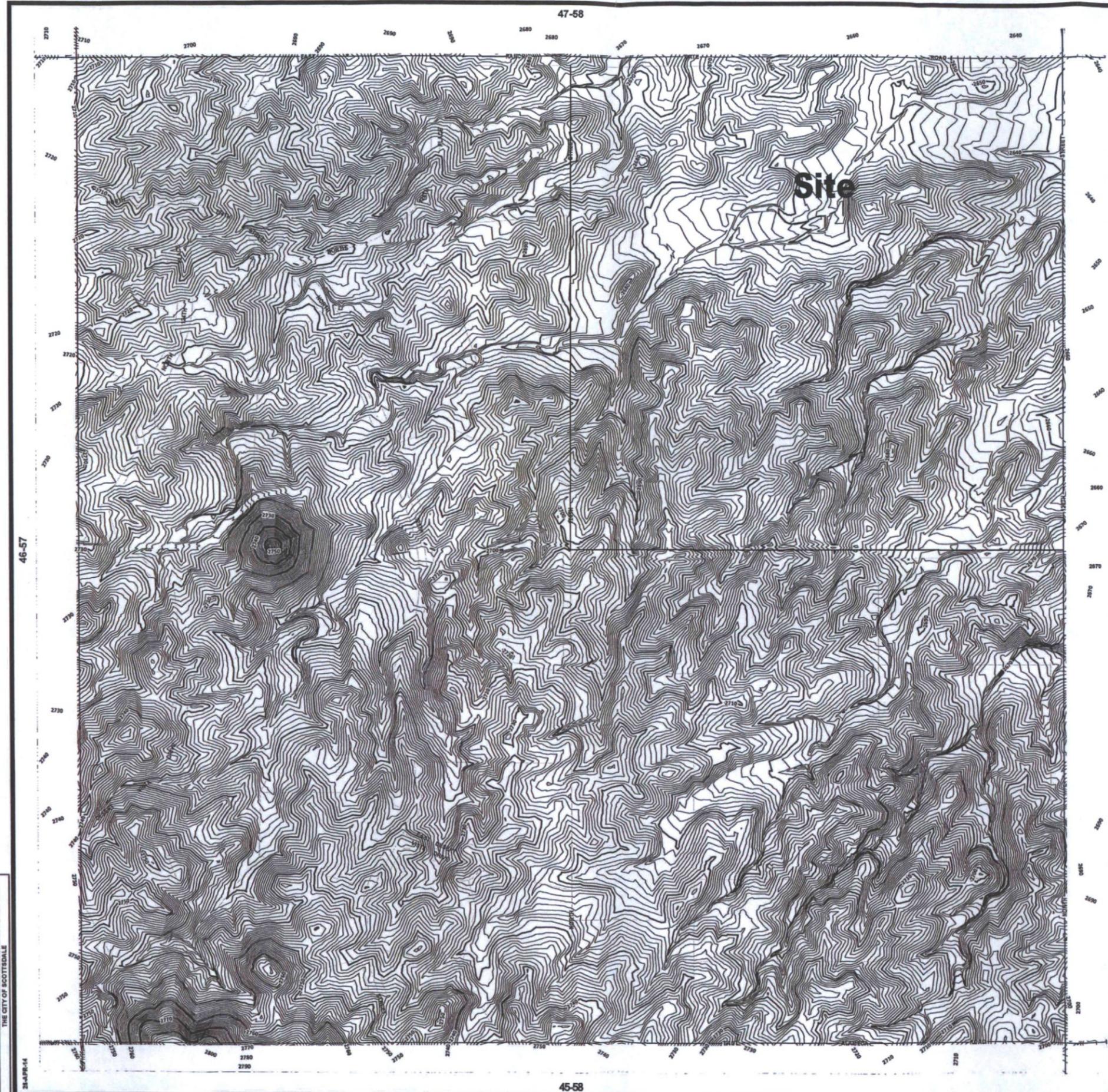
+ 2675

+ 2640

+ 2700

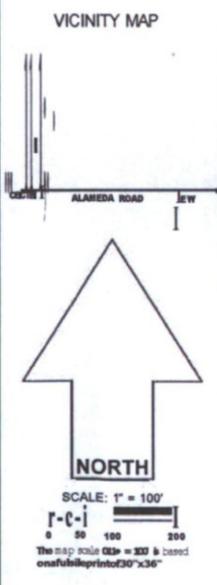
1670

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THE CITY OF SCOTTSDALE



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LEGEND:



CONTOUR
QUARTER SECTION MAP
46-58
NE 1/4 SEC. 11 T4N R5E

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS
333 8th Street, Scottsdale, AZ 85262
303.440.1111 ext. 2111

EXHIBIT 4